Concrete for the Farmer

UNIVERSAL PORTLAND CEMENT CO.

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Concrete for the Farmer

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Table of Contents

Page

Introduction 7

Advantages of Concrete Construction
Cost
Durability
Resistance to Fire
Losses from Rats and Other Vermin
Sanitation
Accessibility of Concrete Materials
The Selection and Proportioning of Aggregates
Purpose of the Booklet

Foundations and Piers 13

Building Foundations
Piers
Machinery Foundations
Replacing Foundations

Basement and Cellar Walls 17

Cellarways and Steps 18

Side Walls
Steps

Concrete Walls 21

Monolithic Walls
  Single
  Double
Reinforcement
Surface Treatment of Concrete Walls
Block Walls
Laying Blocks
Stucco Walls
Unit Construction

Floors and Pavements 27

Two-Course Work
Single-Course Work
Sidewalks
Driveways
Horse Blocks
Floors of Buildings
Porch Floors
Dairy Barn Floors
Corn Crib Floors
Feeding Floors and Barnyard Pavements

Concrete Tanks 36

Stock Tanks:
  Rectangular
  Circular
Hog Troughs
Dipping Vats
Hog Wallows
Manure Pits
Cisterns
  Arch Top Cisterns
Septic Tanks for Farm Residences
Waste Water Receptacles
Concrete Silos
Water Storage Tanks

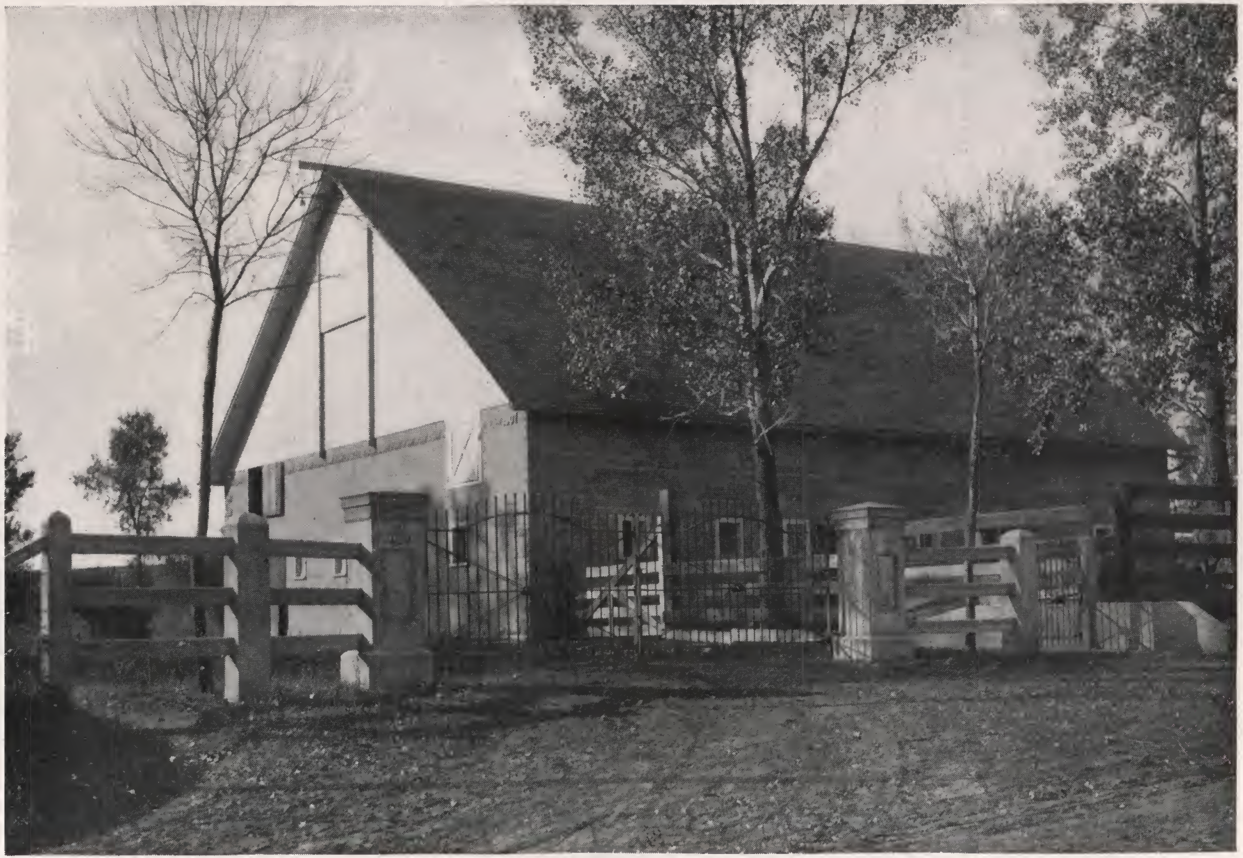
Concrete Building Blocks 47

Farm Buildings 49

Residences
Garages
Barns
Hog Houses
Poultry Houses
Milk Houses
Ice Houses
Root Cellars
Machine Sheds

Miscellaneous Uses of Concrete 63

Concrete Stalls and Mangers
Nests for Hens
Hot Beds
Cob Burners
Scale Pits
Concrete Curbing in Old Wells
Pump Pits
Fence Posts—Corner, Gate and End Posts
Grape Arbors
Concrete Fences
Concrete Dams
Tree Surgery
Pipe Culverts
Bridges



An example of what concrete can do for the farmer. Such improvements increase farm efficiency.

Concrete for the Farmer

Introduction

For many years the farmer's chief building material has been wood. At one time it was plentiful and therefore an economical material to use. The land had to be cleared for agricultural purposes and because of the farmer's nearness to the timber supply, it is but natural that he used wood almost to the exclusion of other building materials and has continued to do so while it has been largely discarded in the larger communities.

Advantages of Concrete Construction In recent years the timber supply has rapidly decreased and the price of lumber has increased accordingly. Because of the rapidly increasing price of lumber, frame construction can no longer be considered economical in most localities and the progressive farmer has already turned his attention to other building materials. He has found that concrete is suited to his needs for it is not only low in first cost, but is durable, fireproof and sanitary as well.

Cost A farm structure has often been built as cheaply of concrete as it could have been built of lumber, but as a general thing the first cost of concrete is slightly greater than that of frame construction. However, it should be remembered in this connection, that the first cost is not usually the most important.

Durability The average life of a frame building is not over 20 years. If such a building is kept in proper condition the actual annual cost of maintenance will be about 5% of the original cost, so that in 20 years a building that cost $1000 to build has cost another $1000 for maintenance charges. If this investment for repairs is not made the building will be so dilapidated after 20 years that it will be considered by a prospec-

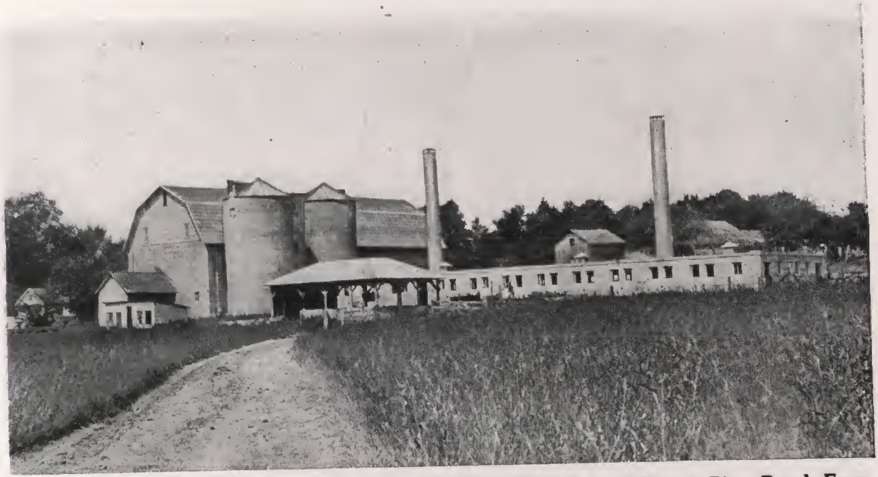


Figure 1. Concrete Dairy Barn, Hay Barn, Silos, Milk House and Manure Pit. Beach Farm Dairy, Coldwater, Michigan. The dairy barn is the low structure to the right of the illustration, and is ventilated by means of two concrete stacks.

tive purchaser as a detriment, rather than an improvement to the property. It is not necessary to paint concrete in order to preserve it, nor to make repairs, for it will not go to pieces when exposed to the weather; in fact a concrete structure will get stronger and better with age. The annual saving thus effected with concrete structures will soon eliminate any difference in first cost between concrete and wood.

Resistance to Fire Insurance statistics show that the total fire loss in the United States and Canada in 1913, was $224,723,350, but these figures do not include the enormous additional losses in time and inconvenience which follow conflagrations as indirect results. Insurance companies know from experience that the salvage of fire swept farm buildings of frame construction is relatively small, and hence impose a large insurance rate on such structures. Real fire protection can only be obtained by building of a fireproof material, and where such a material is used, insurance fees may be wholly or partly done away with.

Losses from Rats and Other Vermin The loss by fire on American farms is great—but it is a spectacular loss, and cannot be concealed. Rats and other vermin cause the farmer, small, but steady and needless losses and are often a source of considerable trouble. In Japan, the Bubonic plague, spread by rats, was checked by the erection of rat-proof, rice and grain warehouses of concrete. It is estimated that there are 500,000,000 rats in the United States. Assuming that each rat does damage of only one-half cent per day, the total loss to the country in one year would be almost one billion dollars. A family of rats in a corn crib have been known to damage over one dollar's worth of corn in a night.

Concrete foundations and stable floors keep the rats from living under the barn. The grain bin or corn crib should have a concrete foun-

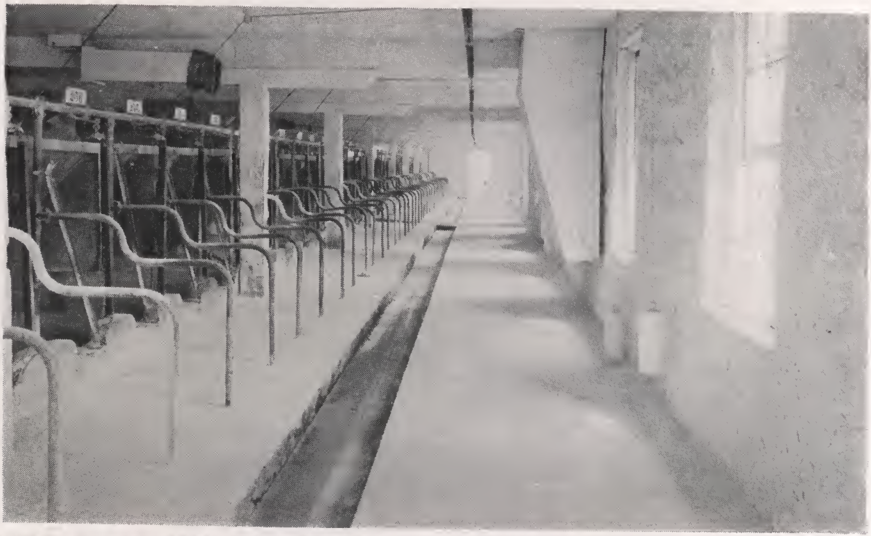


Figure 2. Interior of Dairy Barn, Jelke Farm, Dundee, Illinois.

dation, a concrete floor above grade and at least the first three or four feet of the sides, should be of the same material. This is the only successful way of keeping out rats and other similar vermin. The all-concrete grain tank or corn crib is recommended to the farmer. If a good fireproof and ratproof storage is provided the grain and corn can be held for a rise

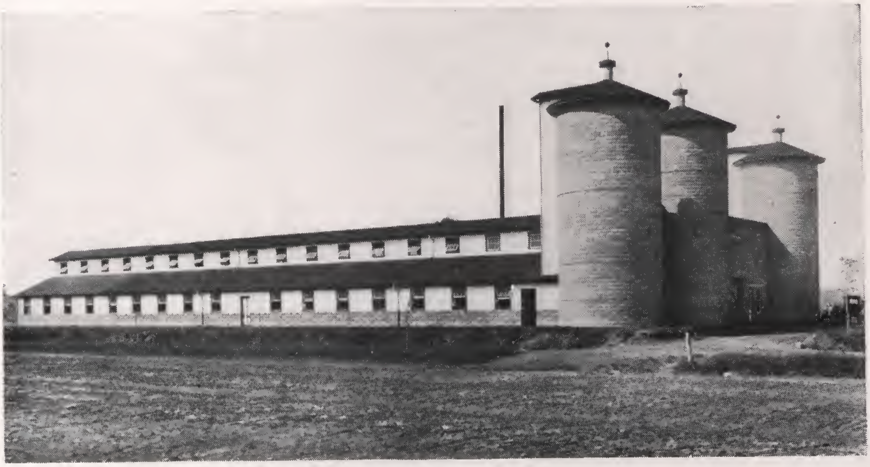


Figure 3. Beauchamp Dairy Plant, Pacific, Mo.

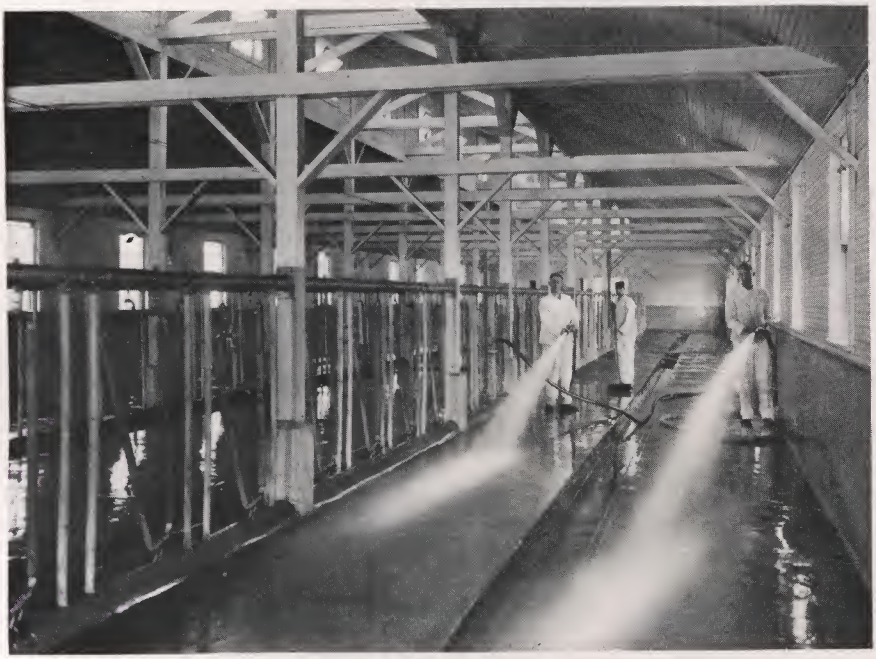


Figure 4. Interior of Beauchamp Dairy Plant, Pacific, Mo.

of the market, which should be one of the best ways of getting more than the thirty-five cent dollar. The idea that grain spoils in a concrete structure appears absurd, when one considers the thousands of grain elevators of concrete in the United States and Canada.

Sanitation Farm structures of all kinds must be kept sanitary to give best service. Where articles of human food are concerned sanitary surroundings are absolutely essential. Animals of all kinds need clean quarters and decaying wood construction has frequently been pointed out as a chief source of infection. Concrete is hard and impervious and presents a smooth surface. All inside corners can be rounded to prevent the accumulation of dirt, thus making the structure easy to keep clean. No other material offers the sanitary advantages of concrete.

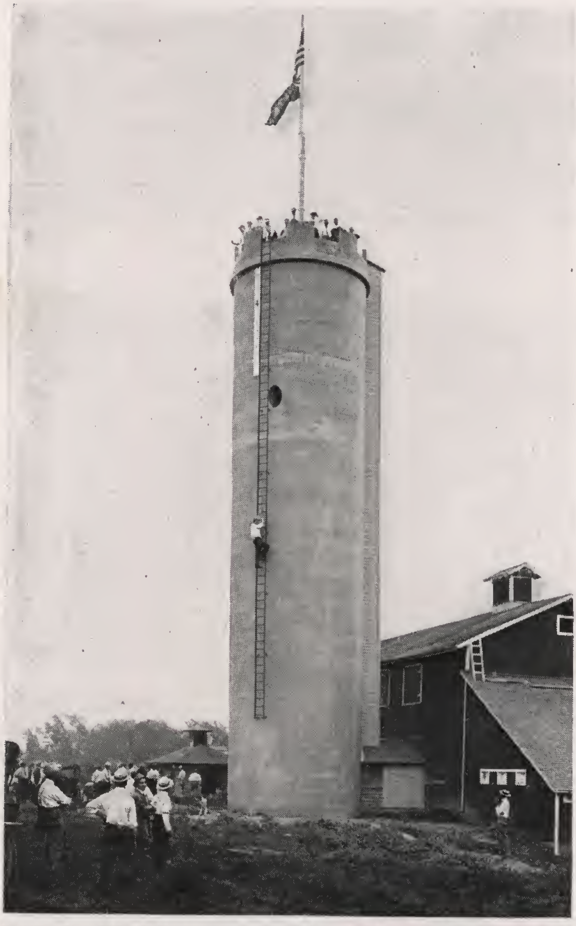


Figure 5. Monolithic Concrete Silo on Mooseheart Farm, Batavia, Illinois. This is one of the highest in the world, 79 feet, 6 inches high. It has a water tank on top 12 feet deep.

Accessibility of Concreting Materials

Probably the main reason why the up-to-the-minute farmer is using concrete construction in preference to other types is that all the materials necessary for such work, except the cement itself, can often be obtained on his own farm. In this way gravel and sand are often obtained for the cost of hauling.

Selection of Concrete Aggregates

Before going ahead with the work, careful attention must be paid to the materials mixed with the cement to form concrete. These materials are commonly referred to as aggregate. Careful selection of the aggregate is necessary in order to obtain good concrete. It must be clean, coarse, hard and well graded. Clean, because if the separate particles are covered with a coat or film of any kind, the cement cannot form a good bond. Coarse, because a coarse aggregate presents a much smaller surface for the same volume, and is also more easily covered with cement than a fine one, thus making stronger concrete with the same proportion of cement.

As a chain is no stronger than its weakest link, so concrete is no stronger than the weakest particles of which it is composed. Consequently the aggregate must be hard and remain hard under all weather conditions. Some sands and gravel contain shale-like particles, which after exposure to weather for a short time, go to pieces. Sometimes stone is used, which is of a chalky nature and that, naturally, does not give good results.

The particles of the aggregate which will pass a ¼-inch sieve, are considered as sand. The sand must be free from an excessive amount of fine material. A mixture of cement and fine sand cannot possibly give as great strength as a mixture of the same proportion of cement and coarse sand; therefore, the use of fine sand should be avoided. If it is the only sand at hand a coarser material should be obtained to mix with it, or a larger amount of cement used. The coarse aggregate, either screened gravel or crushed stone, should all be coarser than ¼-inch, and for ordinary work the maximum diameter should not be greater than 1½ inch. The materials should be proportioned accurately. One sack of cement, 94 lbs. net, is considered one cubic foot and each batch of concrete should be some multiple of one sack.

It frequently occurs that gravel is used as it comes from the natural deposit. This should not be done on account of the excess amount of

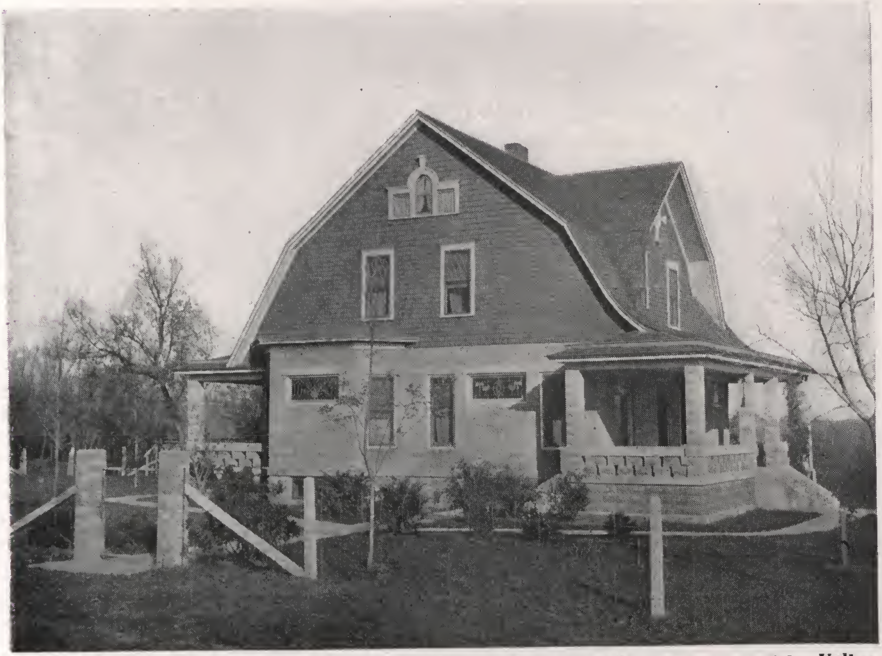


Figure 6. Concrete Block Farm Residence with other concrete improvements, Echo Valley Farm, Odebolt, Iowa.

fine material contained. A 1:2:4 mixture, with screened material, is not the same as a 1:6 mixture, with bank run gravel. If the sack of cement is added to 2 cubic feet of sand, the resulting mixture will have a volume only a little more than 2 cubic feet, because most of the cement goes to fill the voids or air spaces in the sand. When this mixture is added to 4 cubic feet of screened gravel, the resulting mixture has a volume only slightly larger than 4 cubic feet, as the voids in the gravel take up most of the cement-sand mixture. The volume resulting from the addition of 1 sack of cement to 6 cubic feet of bank run gravel, is not increased by the cement, because in this case one sack of cement does not fill all the voids which is necessary before the volume could be increased. Since a sack of cement will make but a little more than 4 cubic feet of concrete with a 1:2:4 mixture, using screened aggregate, and 6 cubic feet of concrete with a 1:6 mixture, using bank run gravel, it is therefore, readily seen that a 1:6 mixture is leaner than a 1:2:4 mixture, and will not make as strong a concrete as the latter. Furthermore, since bank run gravel usually contains an excess of sand, the relative amounts of sand and gravel in the mixture are not properly adjusted. With bank run gravel it is always better to separate the sand and gravel by screening and then to remix the two with the cement in proper proportions.

Purpose of the Booklet Not all of the concrete work that has been done has been done properly, and it is with a view of raising the standard of concrete construction on the farm that this booklet is written, as well as to suggest further uses of concrete to the farmer. It is not the purpose of this booklet, however, to give complete details of construction for all of the uses of concrete taken up in it. Wherever possible, references are given in foot notes to other booklets published by the Universal Portland Cement Co., which contain more detailed information on the subject discussed, than is given in this publication. Any of the booklets referred to may be obtained by addressing the nearest office of this company.

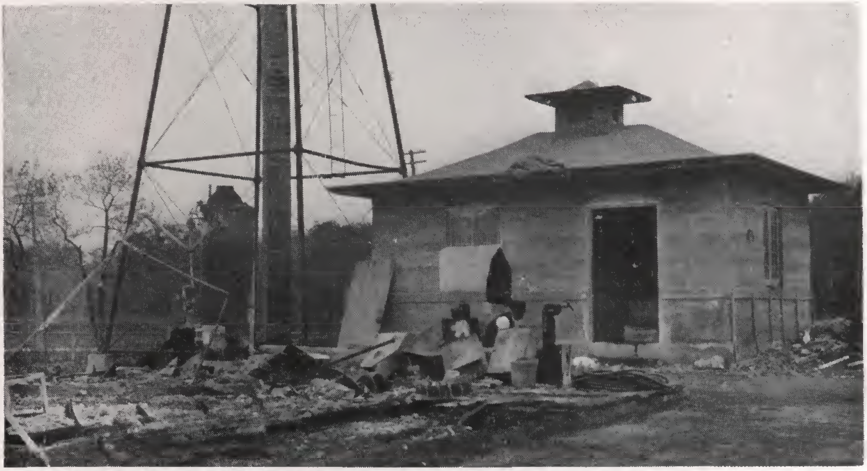


Figure 7. Monolithic Milk House on Crabtree Farm, Lake Bluff, Illinois, after a fire which destroyed practically every other structure on the farm.

Foundations and Piers*

One of the advantages concrete has over other materials used for foundations is the ease with which it can be placed by ordinary farm labor. A concrete foundation of an irregular shape can be poured just as easily as one that is regular. The foundation should always extend well below the frost line, to a hard, firm sub-soil, in order to prevent heaving by frost and settling.

Building Foundations Farm structures are generally located with reference to a driveway or other existing buildings. A convenient location will save loss of time and money after the structure is in use, and this feature deserves special attention.

In firm soils, the sides of the trench will stand straight enough so that form work below ground will be unnecessary. The width of the trench should be as nearly as possible the same as that desired for the foundation wall, when concrete is to be placed directly into the excavation. Care should be taken to protect the edges of the trench and to keep dirt out of the concrete.

As it is desirable that the floors of all buildings should be somewhat higher than the ground level, it is customary to carry the foundation a short distance above the ground, and for this purpose forms like those shown in Figure 9 will be necessary. These forms may either be constructed in sections and then set in position or built in place. If the inner and outer parts of the form are built separately in sections, they must carefully be leveled and plumbed as units and care must be taken in placing each timber. The forms must be thoroughly braced and tied together, in order to hold them rigidly in place, until the concrete has hardened. It will be noted in Figure 9 that the forms are suspended over the trench and are not allowed to rest upon the new concrete.

Figure 9 also shows a convenient method of suspending the bolts which are to be imbedded in the concrete for securing the wooden sill or wall plate to the foundation. These bolts are also shown in the illustration; Figure 8. They should not pass through the cleats but should be carried by a block or small board tacked to the cleats; otherwise it would be difficult to remove the form without destroying the cleats.

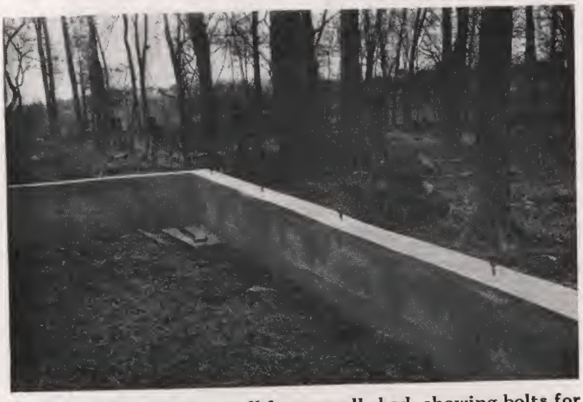


Figure 8. Foundation wall for a small shed, showing bolts for attaching the wooden sill to the concrete foundation; John Domer, owner, Marion, Iowa.

Before filling the wooden forms, the surface of concrete previously placed in the trench should be swept off, to remove dirt, leaves or other foreign matter. If it has become dirty, it should be washed and while still wet brushed with a cement and water grout mixed to the consistency of thick cream. Concret-

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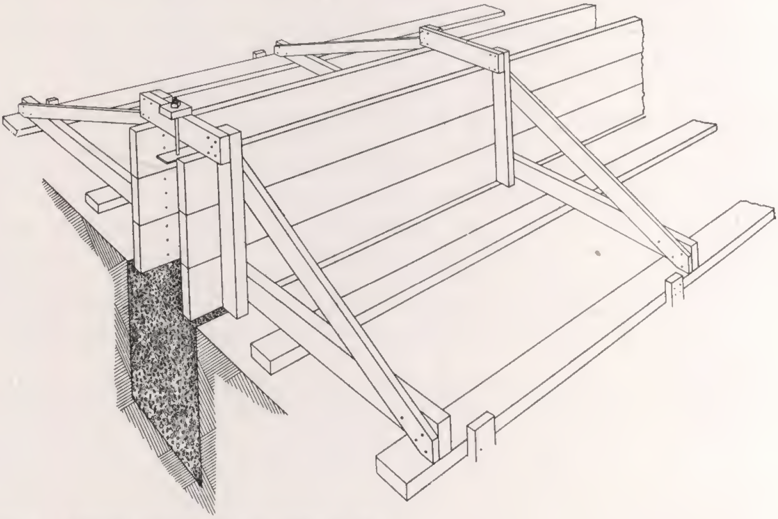

Figure 9. Forms for concrete foundation wall.

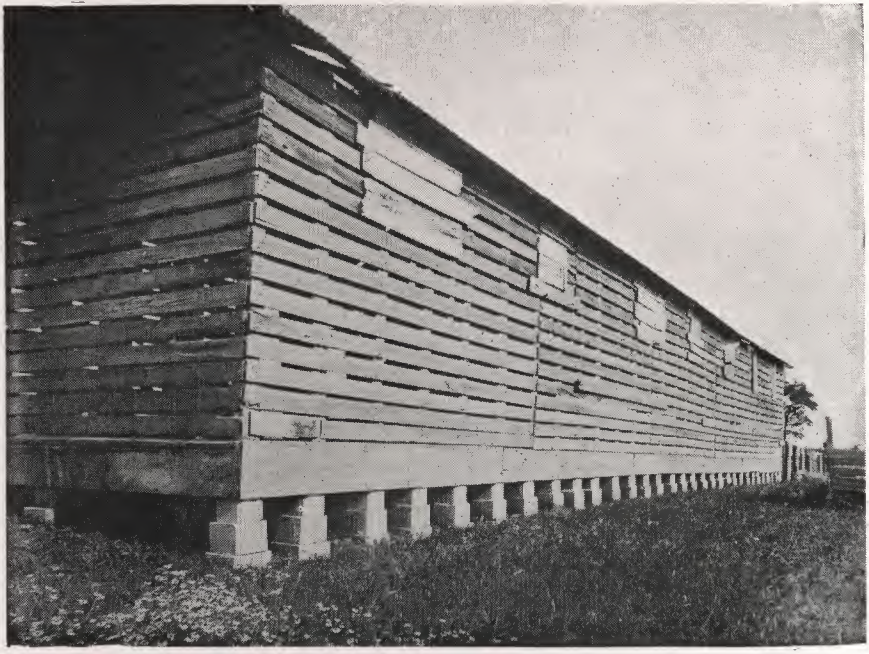

Figure 10. Concrete pier supports for a large corn crib.

ing should be resumed before the grout has had time to dry. This treatment will insure a good bond between the old concrete and the new and should always be used when joining work that has hardened.

Concrete for foundation walls should be mixed in the proportions of 1:3:5, that is 1 sack of Portland cement to 3 cubic feet of clean, coarse sand, all passing a ¼-inch mesh screen and 5 cubic feet of screened gravel or broken stone, varying in size from ¼ to 1½ inches in its largest dimensions. Sufficient water should be added to the mixture to give it a quaky consistency, such that when piled upon the mixing platform, it will tend to flatten out but will not flow readily.

Piers Pier foundations are sometimes used under light and unimportant buildings, generally where it is desirable to have a circulation of air under the structure. It is not necessary, however, to use a foundation of this sort to provide a dry floor. Properly constructed concrete floors used in connection with well made foundation walls built of this material will be entirely dry. Pier foundations effect a saving in material over foundation walls, but have several disadvantages. The piers are apt to settle unequally unless carefully constructed, and twist the superstructure out of line and level. The floor of a building supported in this manner is also apt to be cold in winter weather.

Machinery Foundations* Concrete makes ideal foundations for engines, cream separators and other such machinery. The form work is generally simple and may be put up in a few minutes' time.

When the earth is firm enough, the lower part of the foundation can be built without forms. The top of the foundation should usually be six inches or more above ground, however, as a protection to the machinery. Forms for the top may be made of 1-inch or 2-inch material, as convenient. The top of the foundation should be made perfectly level and the edges rounded.

The accompanying sketch (Figure 11) shows a foundation for a gasoline engine of the type now used extensively on the farm. The foundation is merely a block of plain concrete, resting on a firm sub-base, with anchor bolts properly set, by means of which the engine is held in place. Concerns manufacturing these engines usually state the length of anchor bolts and size of foundation needed for the various sizes of machines.

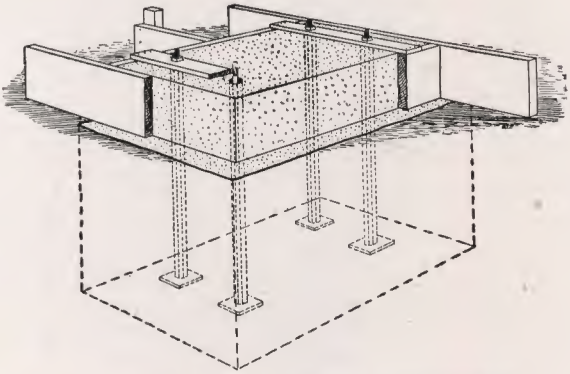

Figure 11. Sketch showing gasoline engine foundation.

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Replacing Foundations Foundations of stone and brick are apt to decay and crumble. This condition frequently exists in buildings which are otherwise in a fair state of preservation and well worth saving. Concrete is the best material that can be substituted for the crumbling foundation. If the foundation wall has not gone to pieces very much it can be left in position and boxed in with concrete, but if the foundation is in bad shape it will be necessary to remove it completely and replace with concrete.

If that part of the foundation wall below ground is in good condition, it may be capped with concrete, as shown in Figure 12. If the sills and a portion of the posts and the siding are decayed they must also be replaced. It will be necessary to take the load off the posts temporarily so that the decayed portions may be removed and this may be done as shown in the figure. The prop on the inside should be placed under the stringer running out from the post and on the outside it will be necessary to nail a block or board at least 2 inches thick to the wall of the building directly opposite the post to be raised. By the use of wedges, as shown, the load can readily be taken from the post and carried by the props.

The old sill should be removed and the posts cut off above the decayed portion. If the posts are all decayed to a comparatively uniform height they should be cut to the same length or any number of adjoining posts may be cut to the same length, and the concrete foundation wall built up accordingly. If an occasional post is in a worse condition than the others, it can be cut and spliced so as to be the same length as those next to it.

The general methods of building the forms and placing the concrete are similar to those used in the construction of ordinary foundation walls of concrete.

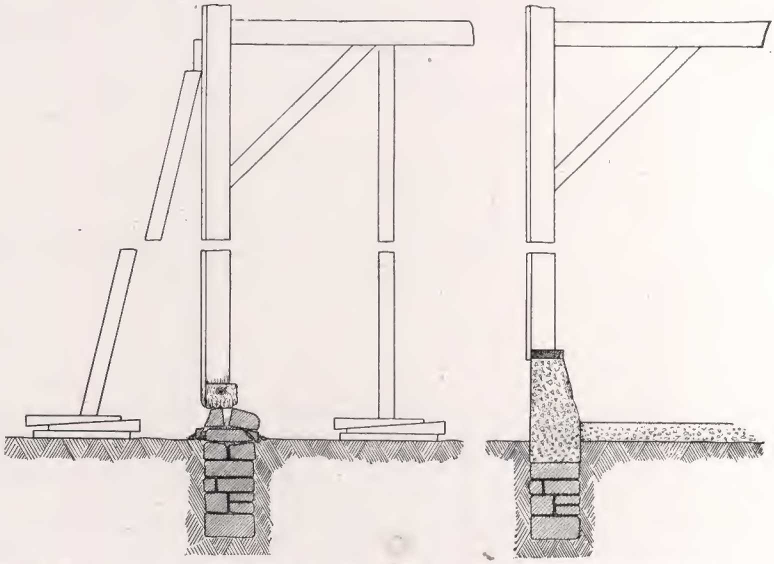

Figure 12. Showing method of replacing crumbled foundations with concrete.

Basement and Cellar Walls* Concrete has several advantages for use in the construction of basement and cellar walls. When properly proportioned, mixed and placed it is watertight without the addition of any waterproofing material. Thus a cellar having properly built concrete walls and a concrete floor will be dry. It will also be sanitary and easily cleaned.

The construction of basement walls is similar to the construction of foundation walls. The concrete should be mixed in the same proportions, that is, 1:3:5, and to the same consistency. It is likely that the excavation for a cellar will be made by a team and scraper, and in this case the wall of the excavation may not stand straight enough to be used as a form for one side of the wall. In this case, a special form will be necessary.

Unless forms for the whole foundation are to be put up at one time, it will be best to build them flat on the ground in units of convenient length, and then erect them in place. By having the forms constructed in this way, they may be removed and used again, with the minimum damage to the lumber. When the side of the excavation is straight enough to be used as an outer form for the basement wall, that side will require only a low form for the portion above ground.

It is possible to build all forms with stock length lumber, requiring very little sawing, which permits of the lumber being used later for other purposes. White pine is considered the best lumber for the construction of forms, but for work of minor importance, cheaper wood such as spruce, fir and Norway pine may be used. All lumber for the face of the forms should be free from loose knots and a tendency to sliver, and should be surfaced on one side and both edges. If the wall is not to receive a surface finish later, matched lumber may be used to give a smooth finish. Surprising results can be accomplished by using care in building forms and when the lumber is carefully matched there is no need for plastering or any other surface treatment.

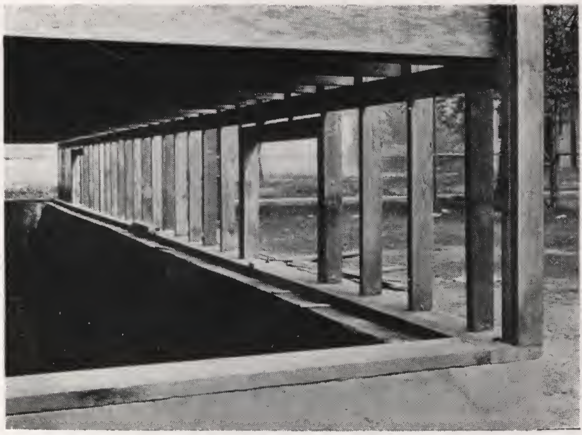

Figure 13. Concrete basement wall under residence, showing method of anchoring wall plates to wall.

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Cellarways and Steps*

If the farm building is to have a basement, a cellarway and steps should be provided. Concrete is the best material for this purpose because it provides a watertight cellarway and durable steps.

Side Walls After the excavation for the cellarway is made, forms for the side walls or retaining walls may be placed. When in position, these forms will rest upon the floor of the excavation made for the steps. As the walls will project above the ground at the building line and slope from this point to the opposite end of the entrance an outside form will be required for this portion. The forms for the side walls should preferably be filled simultaneously. If this is impossible, one form should be braced rigidly at the bottom against the side of the excavation while the other is being filled. After the concrete is in place on one side, the braces within the forms on the opposite side should be removed only as the concrete is placed, for by the pressure of the green concrete on one side, both forms will be pushed out of line, unless sufficient bracing is maintained until the pressure is equalized by the concrete in both forms.

The general methods of constructing the side walls of a cellarway are identical with the construction of foundation and basement walls.

Steps In building cellar steps, the concrete should be mixed with as much water as can be used without the concrete flowing from one step to those below. If the concrete is mixed in the proportions of 1 part

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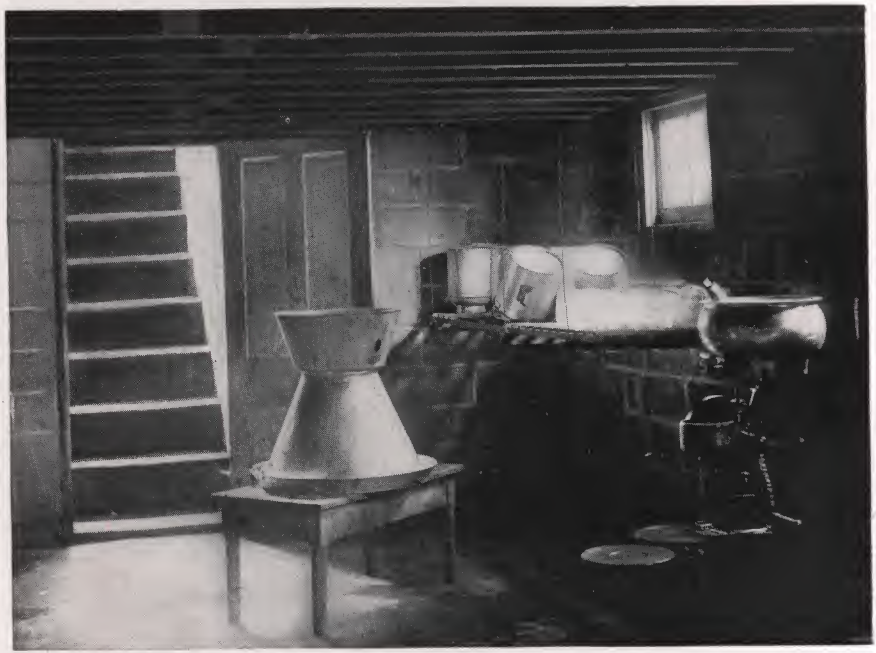

Figure 14. Concrete Cellarway.

cement to 2 parts sand to 3 parts screened gravel or stone, and to the consistency just described, spading along the face of the forms, will give a sufficiently smooth finish. With this mixture it should be possible to obtain a satisfactory finish for the treads, by simply troweling without adding any additional mortar.

A 1:3:5 concrete can also be used for the steps, but with this mixture it will be necessary to use a facing or finishing mortar mixed 1:1½, that is 1 sack of cement to 1½ cubic feet of sand. For facing the risers this mixture should be gauged with sufficient water to produce a stiff, plastic mortar which will spread smoothly under the trowel. This mortar should be applied to the inside face of the previously wetted cross form in a layer ¾ of an inch in thickness, and the concrete body of the step should be deposited immediately afterwards. The spreading of mortar should be done with care so that no air bubbles will remain next to the form. In building steps the treads of which are to receive a mortar covering, the concrete should be brought up to within ¾ of an inch of the surface level, and finished with a thin mortar mixed 1:1½.

Whether the treads are finished with or without an application of mortar they should receive only the troweling that is necessary to work the surface to practically

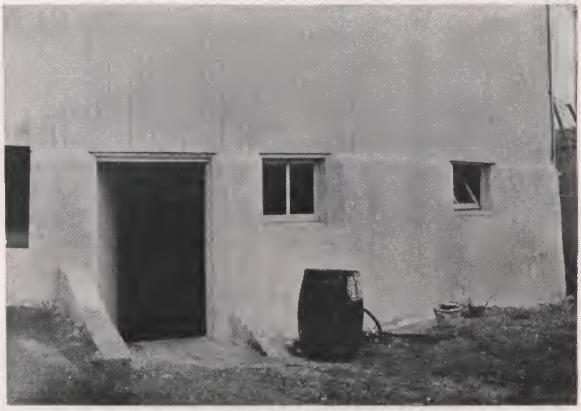

Figure 15. Concrete barn foundation wall with small wing walls at doorway.

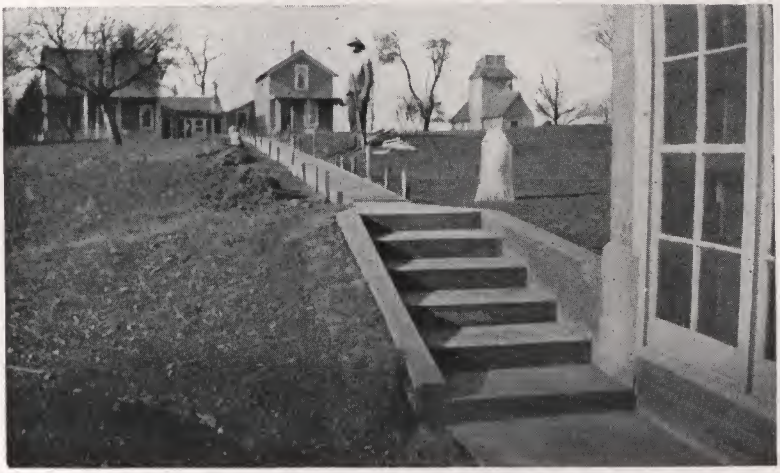

Figure 16. Concrete Steps built in connection with a sidewalk.

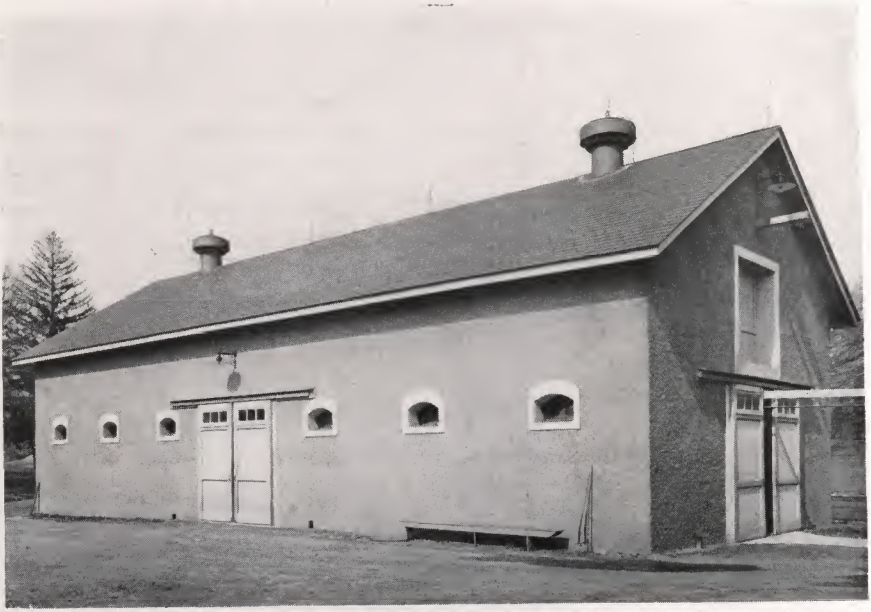

Figure 17. Stucco Building used for Storage of Feed at National Soldiers' Home Dairy Farm, Washington, D. C.

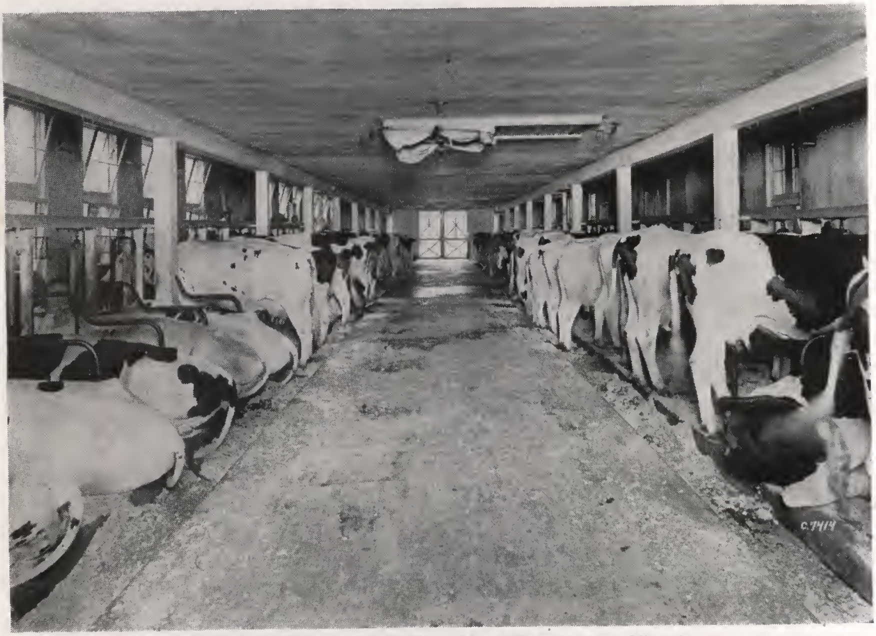

Figure 18. Interior of Dairy Barn of H. Stillson Hart, Barrington, Illinois.

a true plane. Excessive troweling is bad for the surface, and if the work is watched so that the troweling can be done at just the right time, over-troweling can be avoided and time saved. Work finished with a steel trowel will be more slippery than if finished with a wooden trowel, and as it is desirable that the steps furnish a good footing, a steel trowel should be sparingly used, preferably not at all.

Steps other than those for a cellarway, may be constructed in a manner similar to that just described. Concrete steps are often used for porches and in connection with sidewalk construction.

Concrete Walls*

After the foundation walls or basement walls have been placed, the walls of the building may be constructed, and there are a number of materials available for this purpose. The same qualities which make concrete an economical material for use in foundation or basement walls also make it desirable for the walls of the building itself. There are a number of types of concrete walls for farm construction, namely monolithic** block, stucco and unit construction. These different types will be considered briefly in the following paragraphs.

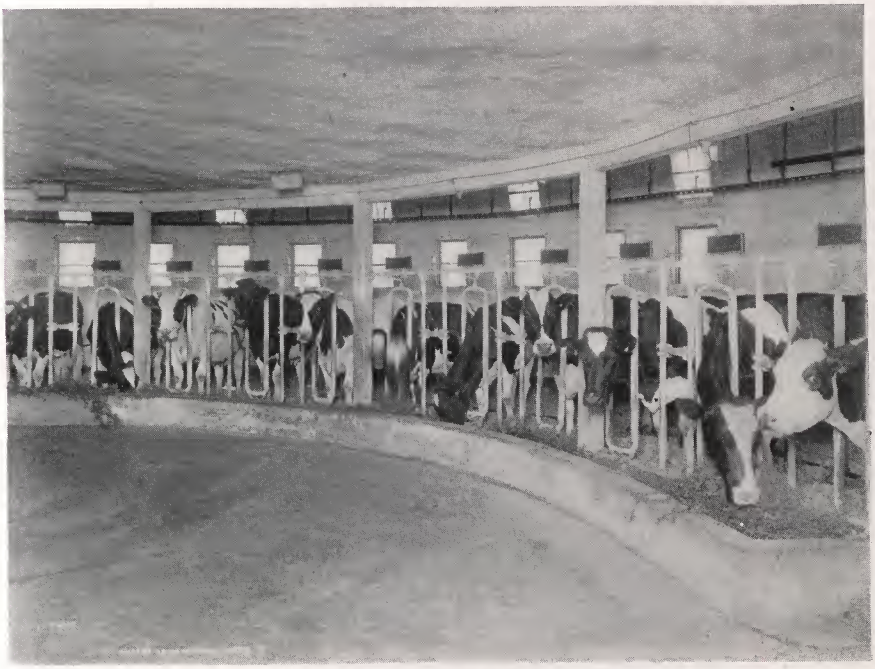

Figure 19. Interior of Circular Dairy Barn of Spencer Otis, Jr., Barrington, Illinois.

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**The word monolithic coming from "mono" meaning "one" and "lith" meaning "stone" is used in concrete work to denote solid concrete, or "as one stone" construction.

Single Monolithic Walls Forms like the one shown in Figure 21 may be built in sections or units, or the forms for a large portion or even the entire wall may be put in place before the concreting is begun. Sectional or unit forms can be used a number of times if carefully removed and assembled, making a large saving in the amount of lumber used.

Double Monolithic Walls In buildings such as ice houses, where it is necessary that a good insulation against heat be provided, double or hollow wall monolithic work is often preferred. Double wall work, as the name implies, consists of two entirely separate walls, with an air space between. To construct double walls of the monolithic type a special wall form is required unless the air space is sufficiently wide to accommodate two single wall forms, back to back. The hollow wall may be constructed with the aid of cores placed in the forms and later withdrawn, or by placing in the center of the wall, tile or other similar material, capable of producing an air space.

Reinforcement* Concrete is strong in compression but weak in tension. Steel is strong in tension, and hence some form of this material is used to take the tensile stresses in a reinforced concrete structure. Concrete is sometimes placed in large masses in dams, retaining walls, etc., and such structures may not be subject to tensile stresses, and therefore will not require reinforcement. However, tem-

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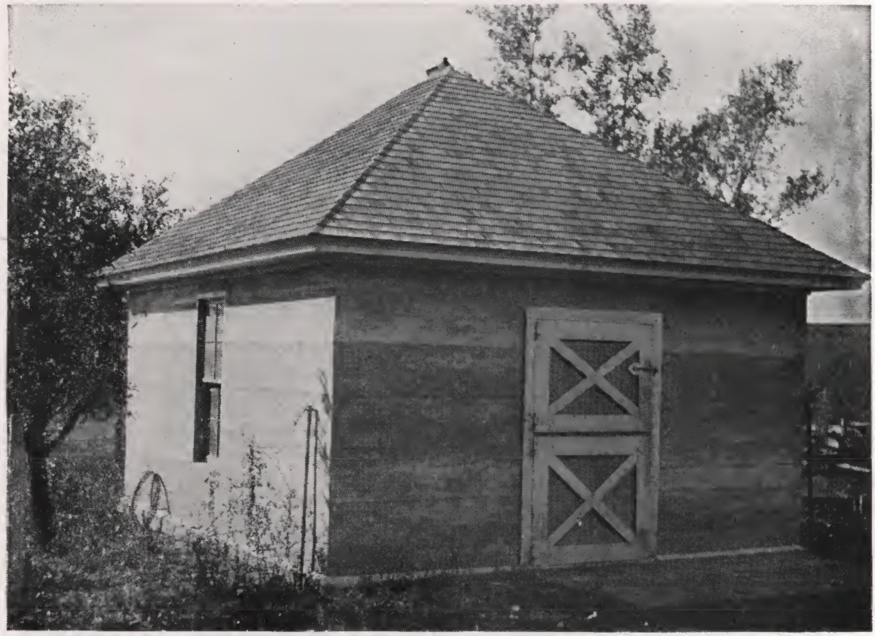

Figure 20. A Farm Blacksmith Shop of monolithic concrete. Echo Valley Farm, Odebolt, Iowa, built by the owner, 1908.

perature changes as well as exterior pressures set up stresses in concrete, and hence it is advisable to reinforce all concrete walls above the surface of the ground. For this purpose a network of horizontal and vertical reinforcing rods will be satisfactory. The rods may be round, square, square twisted or they may be of special section, so long as they have a sufficient effective cross sectional area. The reinforcing network should not be broken at any point, except for doors, windows and other openings. Special care must be taken in reinforcing around such openings, and extra vertical, horizontal and diagonal rods must be used to carry the stresses. Extra reinforcement will also be necessary around wall corners.

Surface Treatment of Concrete Walls*

When concrete has been mixed with sufficient water to insure the best results, a film mortar flushes to the surface, sometimes taking the impress of flaws in the face of the forms, and showing the grain marks of the lumber. Careful workmanship and good forms do much to overcome this, but if a more artistic finish is desired, some further method of surface treatment may be employed. The most common and effective methods are by brushing with weak acids and bush hammering. Painting with a cement grout is not recommended as it is apt to scale off after a very short time, leaving the surface rougher and more unsightly than before. A stucco finish is often given to monolithic concrete walls and makes a very pleasing effect.

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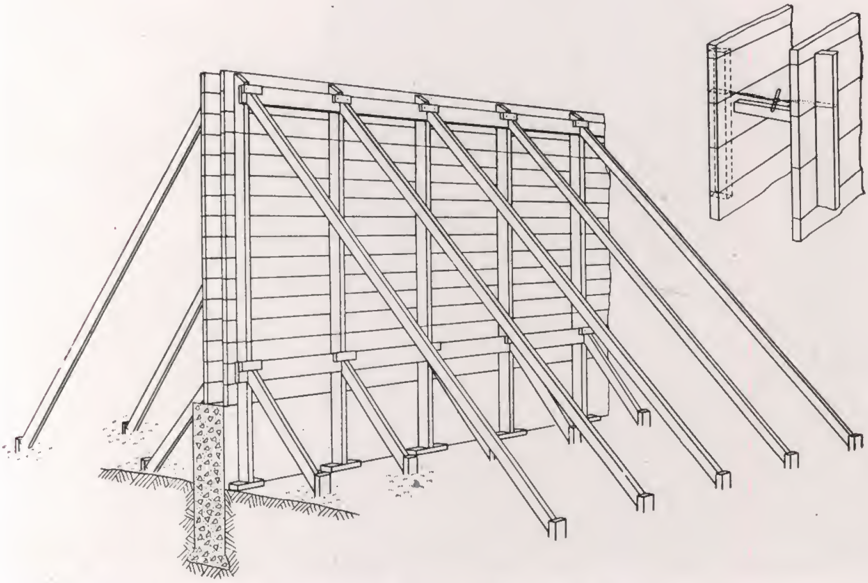

Figure 21. Ordinary Wooden Wall Form, supported from ground.

Block Walls Concrete block may be made at odd times when farm labor would otherwise be idle. Concrete blocks* if properly made and cured, give very good satisfaction, and with the use of attractive mold faces, pleasing effects will result. Another advantage is that concrete block walls may be constructed without the use of forms.

Laying Blocks The rules for laying block walls are simple and the knack of doing neat and rapid work is not hard to acquire. All blocks must be drenched with water before being used or the moisture will be drawn from the mortar. Before laying the first layer of blocks the top of the foundation must be made level, if not so already. The blocks which have been previously drenched are laid in a ¼-inch bed of cement mortar and a quarter of an inch of mortar is placed between the ends of the abutting blocks. Each course is begun at the corners and laid toward the middle of the wall. The blocks should be laid level and kept in perfect alignment. Good alignment is maintained by working strictly to a line stretched over the outer edge of the wall on the same level as the top of the blocks being laid. The wall should be tested frequently by using the plumb board to see that it is perpendicular.

Stucco Walls** Cement plaster or stucco, makes a convenient covering for use in the rejuvenation of old buildings, as well as in the construction of new. Cement plaster may be applied to buildings of either frame or masonry construction, although masonry is generally

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*Page 47 for information on Concrete Blocks.

**"Cement Stucco"; distributed free by the Universal Portland Cement Co.

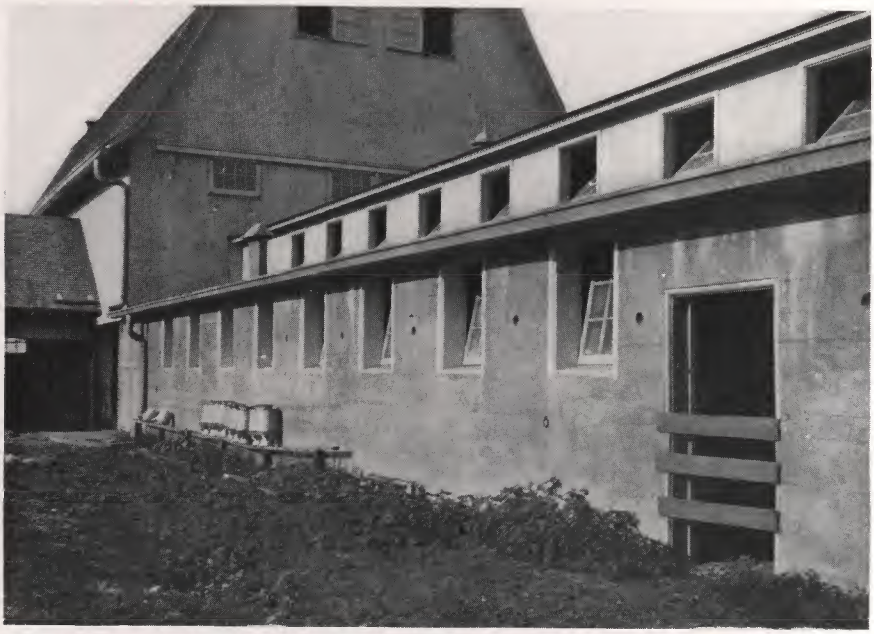

Figure 22. Concrete Walled Stable and Barn, Oak Glen Farm, near Bartlett, Illinois.

considered a better base, because of its rigidity. Thus monolithic concrete, structural cement tile, and concrete blocks are often covered with stucco. Concrete blocks make a very desirable base for stucco work, because the blocks can be cheaply and satisfactorily made on the farm. They are true and even when properly placed in the wall, making it easy to apply the stucco. Blocks for this purpose are made smooth faced, but without a mortar facing. Stucco may be readily applied without elaborate equipment, and a variety of surface finishes and shades may be ob-

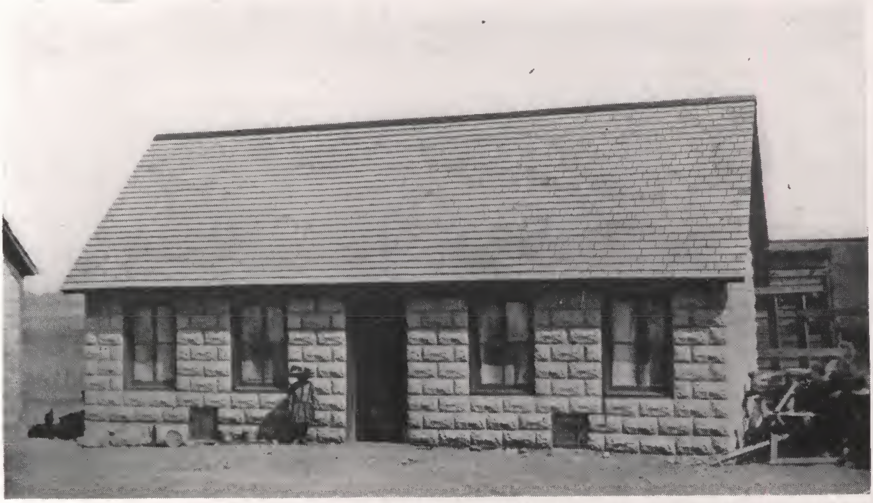

Figure 23. A Chicken House built by the owner, Fred Maas, Lombard, Illinois, who made his own concrete blocks for the walls.

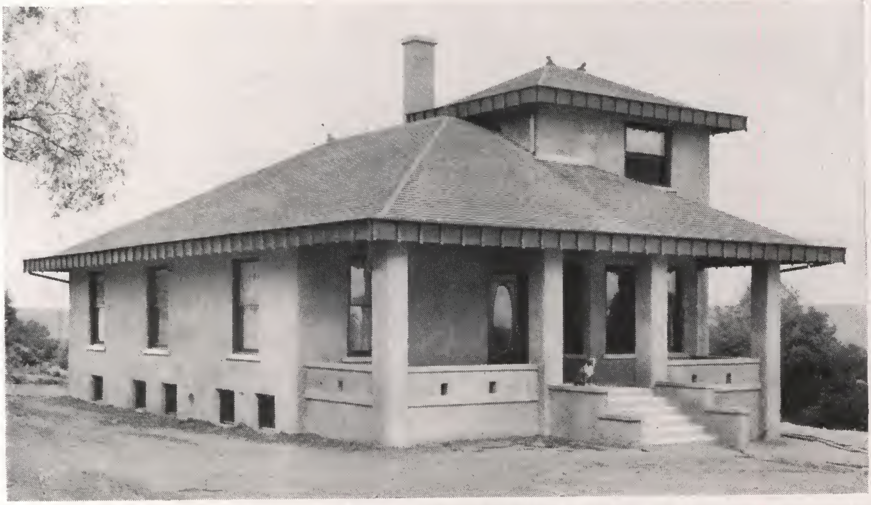

Figure 24. Residence at Lemont, Illinois, having cement tile walls covered with stucco. All floors are of reinforced concrete and partitions are built of cement tile.

tained with it by varying the size and color of the materials used. Any one can learn to apply it successfully, after a little practice, if the rules for such work are carefully followed.

Unit Construction In slab or panel wall construction, individual wall sections and posts or columns are cast separately on the ground and when properly cured, are assembled so as to form a complete wall. This construction is well suited to low buildings, such as cattle and implement sheds, poultry houses, piggeries, etc. The slabs are held in place by columns or posts recessed to receive them as illustrated in Figure 25. These recesses are formed by attaching to the sides of the mold, strips of wood, the dimensions of which are the same as those of the recesses required.

Columns are required on each side of the door or window openings to hold the slabs in line; however in small windows where the depth is not greater than the width of one slab a wood window frame is sufficient. Wherever possible, it is well to place the opening next to the columns, for by this arrangement, only one extra column is necessary for long openings; and for small windows the end of only one slab need be held in line by the window frame.

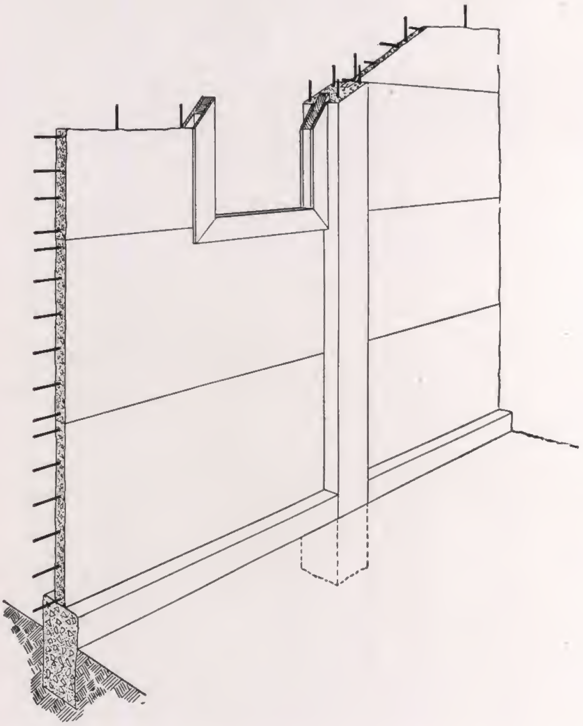

Figure 25. Section of Wall built by the unit method of construction.

Floors and Pavements*

The construction of barnyard pavements, feeding floors, building floors, sidewalks, etc., of concrete is very similar and the general methods of doing such work will be considered in the next few pages. The special advantages of concrete for this purpose are that it is hard, durable, impervious to moisture and easily cleaned.

Glassy surfaces obtained by finishing with a steel trowel are not advisable for work on the farm. Wood float finishes which are level but not slippery are to be recommended for all work of this kind.

There are two general types of concrete paving, one-course and two-course work. Care must be taken in laying a two-course pavement to place the mortar coat before the concrete base has had time to harden, in order to obtain a good bond between the two. In single course work, this difficulty is avoided, and as the two types require practically the same amount of materials, single course work should preferably be used.

Two-Course Work For two-course floors and pavements, a concrete base about 4 inches thick, mixed 1:3:5, that is 1 sack cement to 3 cubic feet of sand and 5 cubic feet of screened gravel or broken stone varying in size from ¼ to 1½ inches in its largest dimension, is first placed in the forms. This concrete is mixed to such a consistency that water will just flush to the surface, under light tamping. A ¾-inch or 1-inch top coat of cement mortar mixed 1:1½ should be placed on top of the concrete base before it has had time to harden, and never should more than half an hour elapse between the time of adding the water to the concrete mixture, and the time of placing the top coat.

Single Course Work Single course pavement is usually made 5 inches thick. Concrete should be mixed 1:2:3. Concrete for the single course work should be mixed to a consistency such that enough mortar will rise to the surface under very light tamping, to permit of finishing with a wooden float.

Sidewalks** The first thing to consider in the building of a walk is the character of the soil to be covered. Sometimes when the soil is heavy, and holds water, a sub-base or foundation of gravel or cinders is necessary to prevent water collecting under the floor and subsequent heaving from frost, but

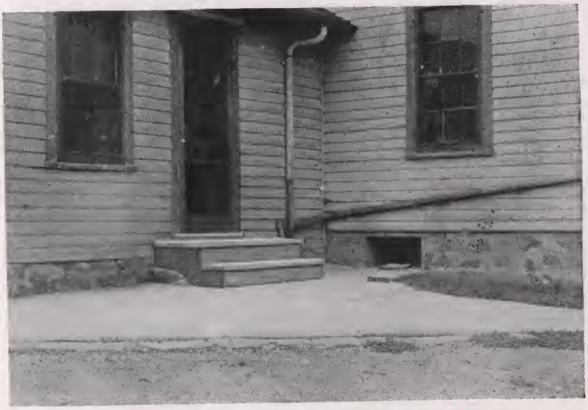

Figure 26. Cement Sidewalk on a modern farm.

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**"Concrete Pavements, Sidewalks, Curb and Gutter," or "Farm Cement News" Vol. 1, No. 4; distributed free by the Universal Portland Cement Co.

when the soil has good natural drainage, the sub-base may be omitted.

Forms for the walk must be provided and should be built of lumber 2 inches thick. One-inch stuff is sometimes used, but is less satisfactory and requires more stakes. Therefore 2-inch material is to be preferred if new lumber has to be purchased for use in forms. Generally speaking, the width of the forms should at least equal the thickness of the walk. The thickness of the walk may be varied somewhat from the width of the lumber used for forms by raising or lowering the forms above or below the surface of the ground upon which they would otherwise rest.

Wherever it is desired to curve the line of the walk or floor, sheet metal or ¼-inch wooden strips of the desired width should be provided, as such material can be bent easily and held in the proper position by stakes. If the work is to look well when completed, care must be taken to place and keep the forms straight and even, and they should also be carefully levelled. If the work is to be built on an incline, have the grade uniform. Sidewalks should be made a little higher on one side than on the other for the purpose of providing drainage; a quarter inch to the foot of width is ample, and this may easily be accomplished by having the forms on one side a little higher than on the other. Another method of providing for surface drainage of the sidewalk is to construct it with a small crown in the center. A walk 30 or 36 inches in width will be found convenient for farms and residences, but sometimes a wider walk may be desired.

There are two satisfactory methods of placing concrete for sidewalks in the forms. One is to lay alternate slabs, and the other is to construct the walk continuously. If the walk is to be built with alternate slabs, as many cross forms are provided and placed as will be required for a day's work. This will divide the stretch in which the walk is to be laid into rectangular spaces. In laying the walk every alternate space is filled. The following day the cross forms may be removed and if there is no other walk to lay, the spaces which have been left may be filled; but when convenient it is best not to fill in these spaces until the first slabs laid are hard enough to walk upon.

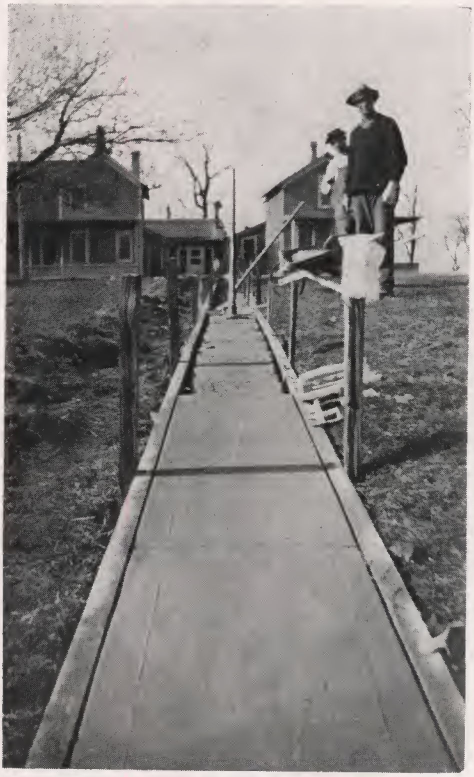


Figure 27. A Concrete Sidewalk on the farm.

If the walk is to be laid continuously, a cross form is placed as described and the concrete packed against it; the cross form is then removed and the next slab tamped between the newly made one and the next cross form. In this case, care must be taken to preserve the vertical joints just mentioned and to mark on the side forms the position of the joint between each slab to serve as a guide in "grooving the top."

Because of the wetter consistency to which concrete for single course work is mixed, the method of pouring alternate slabs as described above; should always be used.

After the walk is finished, it should be protected until thoroughly hard, not protected against pedestrians only, but against rain, frost or too rapid drying out. An excellent practice for out-door work is to cover with fine earth or sand as soon as the surface will permit of such covering without being disfigured.

Driveways Driveways are similar in construction to walks and may be built in the same manner. They should have a thickness of 5½ inches with a 1-inch top, if built in two-courses, and a thickness of 6 inches, if built in a single course. It is common in driveways to provide a rough finish so as to afford a better footing for horses. A sufficiently rough surface may be secured by the judicious use of a wooden float.

Horse Blocks As usually constructed, a horse block is nothing more than a rectangular block of concrete resting on a concrete slab. To look well, the slab carrying the block should project about 3 inches beyond the block on all sides.

In most cases, it will be well to build the walk first, then set up in proper position, a simple box form, the inside dimensions of which equal the size of the block. The whole ex-

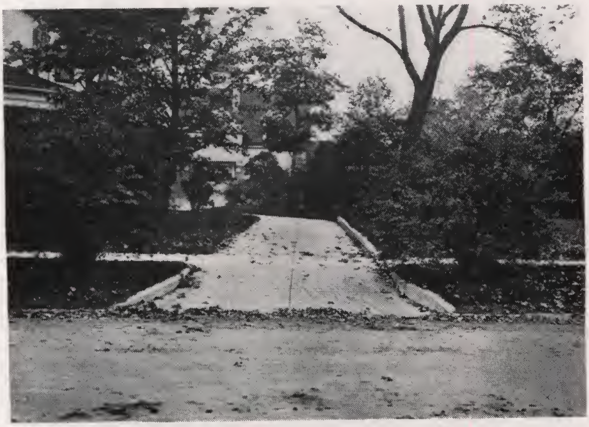


Figure 28. Concrete Driveway.

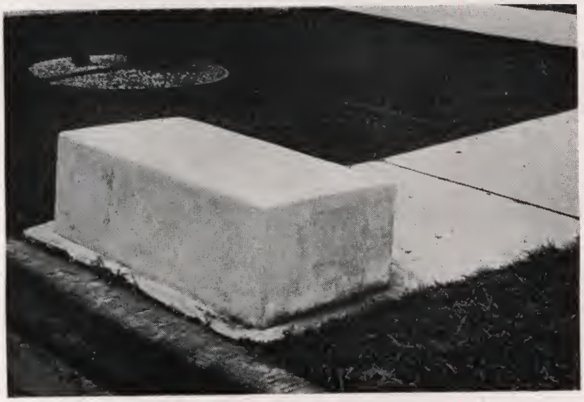


Figure 29. Concrete Horse Block.

posed surface of the block should have a good finish, and to secure this the mortar should be mixed in the proportions of 1 sack cement to 1½ cubic feet of clean, coarse sand. This should be mixed to a plastic con-

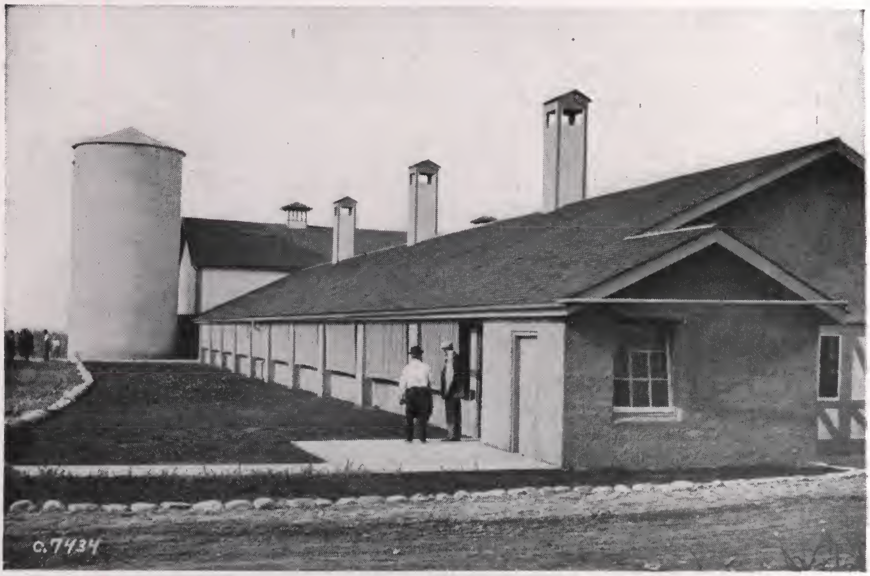


Figure 30. Monolithic Silo and Dairy Barn, with stuccoed, monolithic walls, Wakefield Farm, Barrington, Illinois.

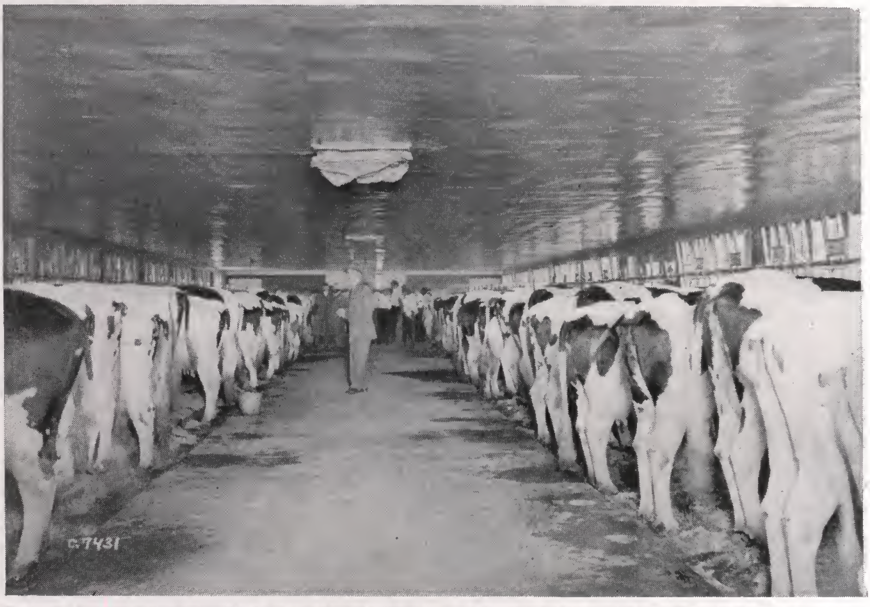


Figure 31. Interior of Dairy Barn of Geo. E. Van Hagen, Wakefield Farm, Barrington, Illinois.

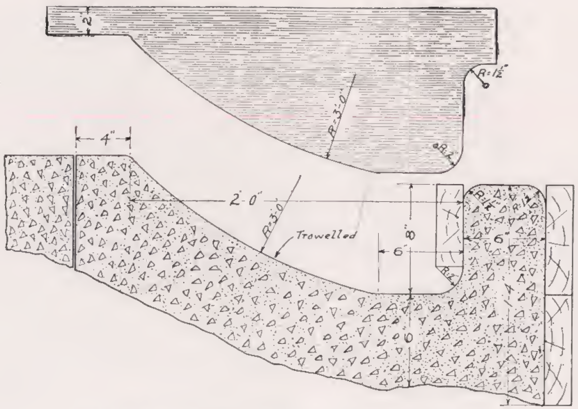
sistency and placed next to the form, filling the interior at the same time with concrete mixed in the proportions of 1:3:5. The corners of the block may be rounded by fitting a concave molding in the corners of the form.

Floors of Buildings Where buildings are to have concrete floors resting upon the ground, the construction of these floors may be considered the same as that of two or more sidewalks laid side by side. However, where a basement floor is below the level of ground water, the floor should be laid in a single sheet instead of being divided into slabs. The methods of making such floors watertight will differ for special cases, and persons desiring suggestions are invited to write the Universal Information Bureau.

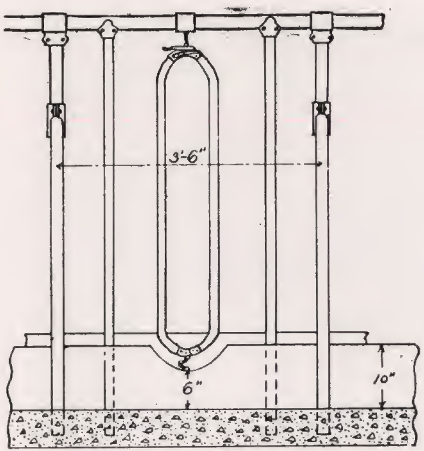
The floors of farm buildings are usually constructed 5 inches in thickness, if built of one-course work, which is preferable. It is not customary to place a sub-base under such a floor, where the ground is level and reasonably solid, for the reason that the foundation walls of the building usually prevent the accumulation of water under the floor. When the floor is laid upon a fill it is advisable to use cinders or gravel, laid in 6-inch layers, each layer watered and well tamped separately.

Porch Floors Concrete porch floors should be placed in two courses. The concrete base should be 4½ inches in thickness and should be mixed in the proportions of 1:3:5. The top coat should consist of a 1-inch coating of mortar, mixed 1:1½. Joints should be placed every 6 feet, running across the floor. Concrete porch floors are usually constructed on a fill held in place by concrete walls. Such a fill should preferably be made of cinders or gravel laid in 6-inch layers, watered and well tamped separately. If it is desirable to construct the porch floor without joints, it should be reinforced in both directions with ⅜-inch

Figure 32. Milking time in the dairy barn; concrete floors are used in all sanitary dairies.



Template and Forms for manger and curb.



ELEVATION OF COW STALL

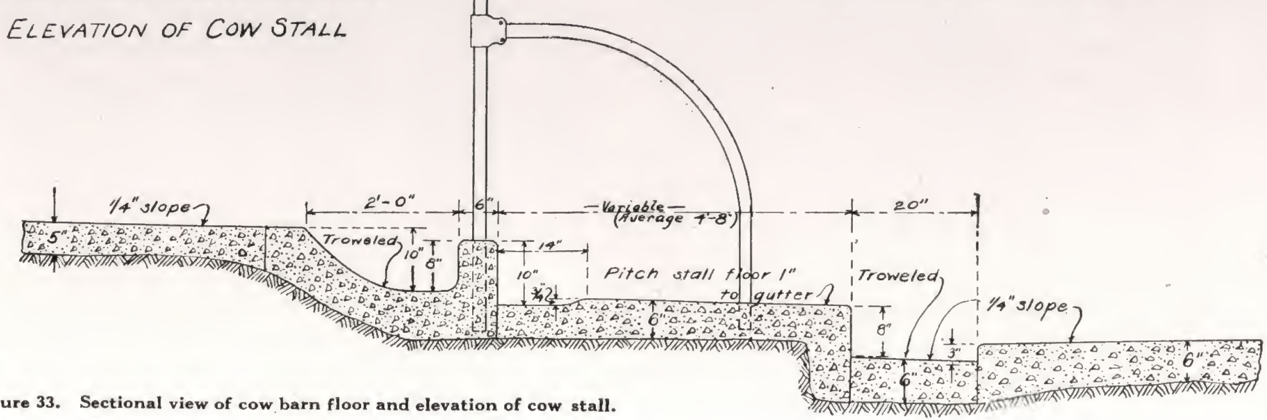


Figure 33. Sectional view of cow barn floor and elevation of cow stall.

round rods, 8 inches apart, placed midway between the top and bottom of the slab, to prevent cracks due to changes in temperature. A suitable wire mesh having an equal cross sectional area of metal may be used instead of the rod reinforcement.

In case it is desired to leave an air space under the floor, it will be necessary to use a reinforced slab and such a floor should be specially designed.

Dairy Barn Floors The ease with which concrete can be kept in a sanitary condition makes its use very desirable in dairy barns. It is especially advisable that the floor of such a building be constructed of concrete.

Figure 33 shows a cross section of a dairy barn floor and an elevation of a cow stall that is considered by dairymen generally, to be an ideal type of construction. The floor is constructed of 1:2:3 concrete laid in one course and has various thicknesses as indicated in Figure 33.

Care should be taken to build the floor exactly as shown in the sketch for all points of construction have been carefully worked out to comply with some special requirement. The feed alley shown on the left may be of any desired width, but a width of 3 feet 6 inches is usually satisfactory. The driveway, a portion of which is shown at the right, may also be of any desired width.

The feed alley slopes ¼ inch to the foot toward the manger, the stall floor is given a dip of 1 inch toward the gutter. The floor, therefore, may be easily cleaned by flushing with a hose. The length of the stall shown as variable on the sketch differs with the breed of cattle kept. Thus its length should be 4 feet 6 inches for Jerseys and 5 feet for Holsteins. On account of the height of the curb in which the stanchions are set, it will be necessary to provide a cut-out as shown in the elevation at the upper part of Figure 33. The division lines shown cutting through the floor, indicate the way in which it is divided up for purposes of construction. The driveway slabs should be constructed first; the feed alley second; the manger third; the stall floor fourth; and the gutter last.

Corn Crib Floors Providing a satisfactory storehouse for corn is a live question with every farmer in the corn belt. Corn cribs, constructed entirely of wood have been used for a long time, but can hardly be considered satisfactory. The wooden floors seem to give the most trouble. After a short time the boards become loose and decayed, allowing the nail heads to project and making shoveling difficult. Every farmer has had experience with the rat nuisance. No building constructed of wood is rat-proof and a wooden floor makes a fine nesting place for rats and mice.

The only material which can be used in the construction of floors and cribs which will not rot out, which will always be ready for use, which will be vermin-proof and at the same time cheap in first cost, is concrete. Experience has proven that corn will keep indefinitely on a concrete floor, if the crib is properly constructed. The floor should be crowning or made to slant toward the outside, so that water which comes in through the open sides will at once drain out.

In general, corn cribs should not be more than 6 feet wide at the bottom, so as to provide a free circulation of air, thereby insuring proper curing of the corn. If the building site is rather high and well drained, it may be possible to get along without a concrete driveway, but this improvement is always advisable. Foundation walls should be provided under

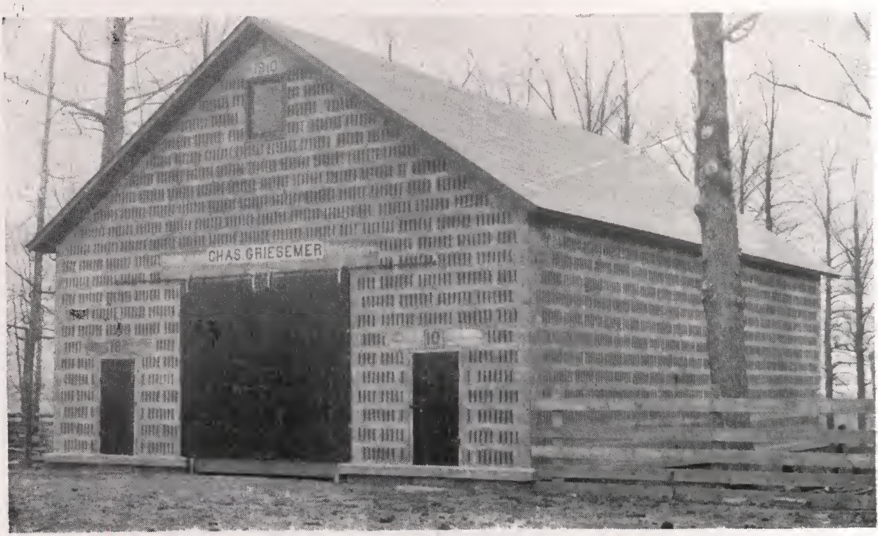


Figure 34. An excellent type of ventilated concrete block corn crib, Charles Griesemer, Hopedale, Illinois.

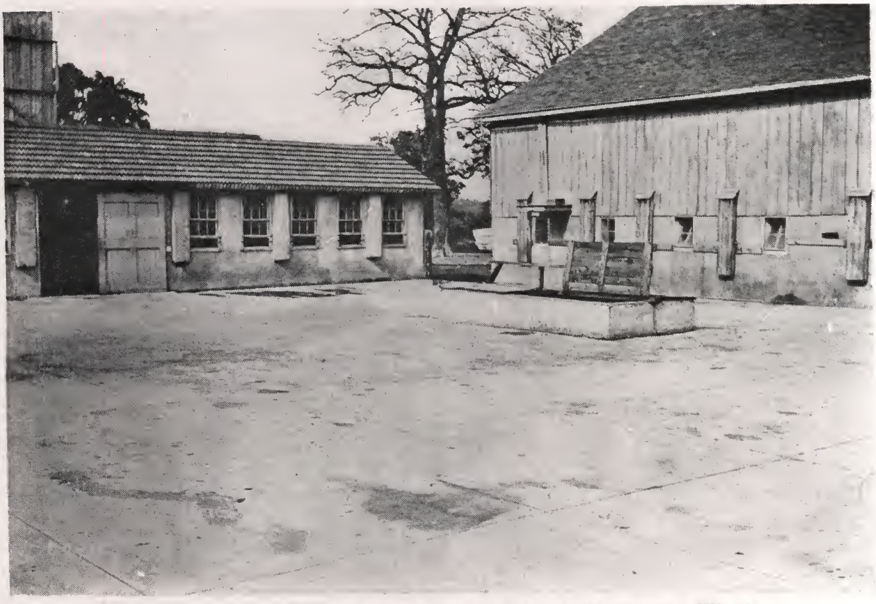


Figure 35. Concrete Barnyard Pavement. Hartwood Farms, Barrington, Illinois.

the crib, especially if it is to stand on a lot which is used as a hog runway, as this will prevent the hogs from rooting under the floor.

Feeding Floors and Barnyard Pavements Concrete paving does away with the muddy feeding lot and barnyard. It effects a large saving in feed and protects the health of the stock, because it can easily be kept sanitary and does away with rats.

A concrete feeding floor and barnyard pavement also effects another saving that is not generally considered—that is a saving in the value of manure. Such a floor should preferably drain into a concrete manure pit, placed at one side of the floor, so as to save all of the liquid manure which contains much of the valuable fertilizing material. A concrete floor was laid at the Ohio State Experimental Station some time ago, and a careful comparison was made between a herd of cattle kept upon this floor and another herd which was kept on a well packed earth floor, to determine the saving effected by the concrete floor in the value of manure. The saving during the first six months of its use paid two-thirds of the entire cost of the floor.

The construction of the barnyard or feeding floor may be considered exactly the same as the construction of a series of sidewalks laid side by side. Such floors should be 5 inches in thickness and should be of one-course work. These floors should have a curbing on all four sides extending about 18 inches below the surface of the ground to keep hogs from rooting under the floor.

Hogs should always be kept away from fresh concrete since they consider it a choice delicacy and their fondness for floors and tanks has caused considerable lost time in reconstruction.

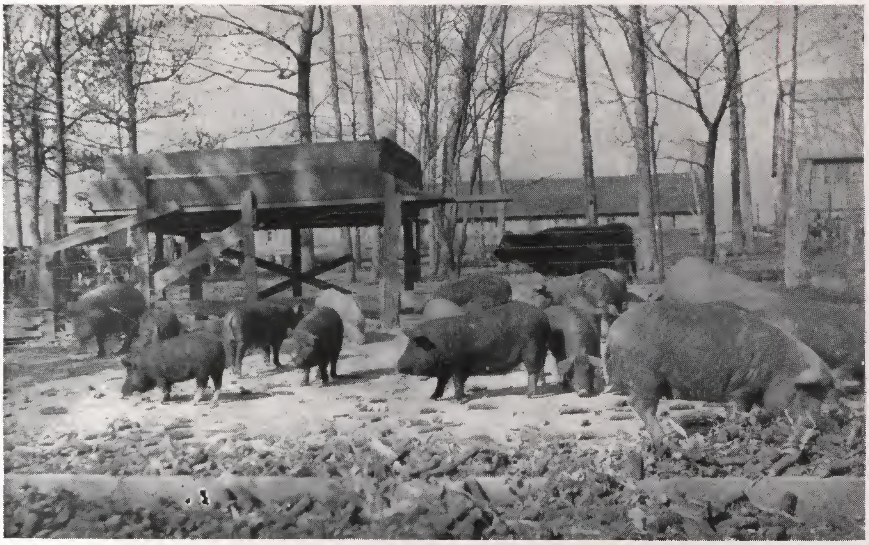


Figure 36. Hog Feeding Floor of Concrete, Funk Farm, Bloomington, Illinois.

Concrete Tanks*

Concrete is an excellent material for use in the construction of tanks. Concrete tanks are easily built, are permanent, watertight and cheap in first cost. They neither rust out, fall to pieces nor absorb water, and are in every way more satisfactory than tanks of any other material.

There are a number of different kinds of tanks for which concrete is being used at the present time. On the farm the most common types of tanks constructed of concrete are the stock watering tank, the hog feeding trough, the dipping vat, the hog wallow, the manure pit, the cistern, the septic tank, the silo and the water supply tank. Suggestions on the construction of each of these types of tanks will be given in the next few pages.

Rectangular Stock Tanks Because of the simple forms required and the ease with which they may be constructed in various sizes, rectangular tanks are preferred by many farmers who wish to do their own work. The size and capacity of the tank will depend of course, upon the amount of stock to be accommodated.

The tank should be constructed entirely of 1:2:3 concrete mixed to a quaky or "jelly-like" consistency. Particular care should be taken to force back the coarse particles of the aggregate from the face of the wall and bring mortar to the surface by spading next to the forms while the concrete is being deposited in order to provide a dense, impervious surface.

It is imperative that the work of concreting should not be interrupted after it has begun, if the tank is to be perfectly watertight. Sufficient materials and help should be used to make this possible.

A concrete floor around a watering tank makes it so much more accessible and sanitary, that one should certainly be built. It should extend a distance of at least 6 feet from the tank on all sides.

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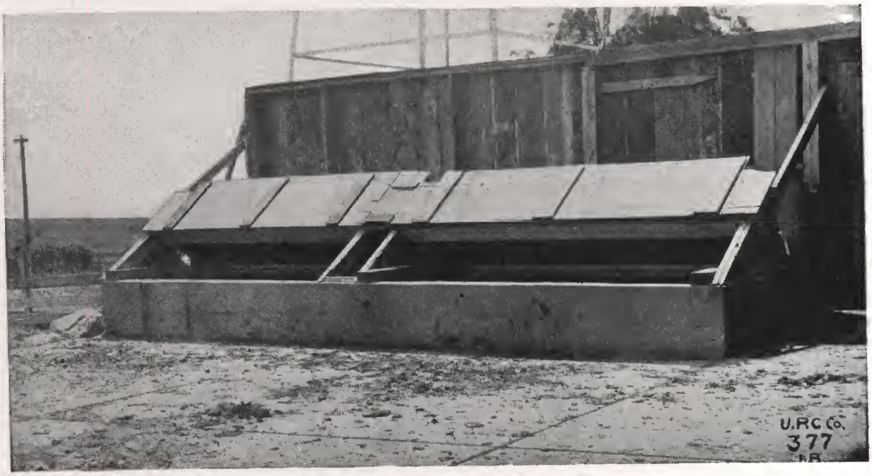

Figure 37. Rectangular Concrete Tank and Concrete Feeding Floor.

Circular Stock Tanks Because of its shape a circular tank will resist frost action more perfectly than a tank of any other form, and is the most economical in material for its capacity, yet the forms are difficult to construct and are, therefore, somewhat expensive. If several farmers in the same community can use to advantage circular tanks of the same diameter, the expense can be distributed. However, if this is impossible, it will probably be better to install rectangular tanks.

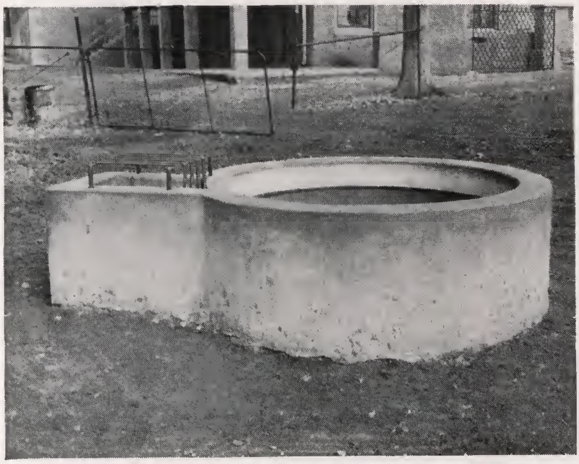

Figure 38. Concrete Stock Tank, National Soldiers' Home Dairy Farm, Washington, D. C.

Hog Troughs

Concrete is very desirable for the construction of hog troughs. Steel or iron troughs rust and leak; wood absorbs moisture, becomes sour and rots.

The troughs shown in Figure 39 are simple and easily built and for a given sized trough the outer form will be identical for each case.

A form for casting a trough upside down, using an earth core, is shown at "B," Figure 39. On a concrete floor, or after leveling off a plat of ground somewhat larger than the proposed tank, build up the core approximately to shape out of plastic earth or clay, using the template as a guage. The bottomless box can then be placed. If on the ground, stakes should be driven about the form to insure it against movement in any direction and if on a concrete floor, the box may be held in position by weights. The core is then worked up to the exact shape desired by using the form as a guide for the template. In this manner a uniform thickness is insured on each side. The height of the core will be equal to the depth of the trough and the height of the template will be equal to the height of the trough. Considerable care must be exercised in working around the earth core so that it will not be damaged. A shield should be used to prevent the fresh concrete from knocking off pieces of the core thus producing an irregular inner surface.

The trough shown at "D" is similar in construction to that shown at "B" with the exception that a wooden core is substituted for the one of earth, and the casting is done on a wooden pallet instead of on the ground. The trough shown at "E" can readily be cast on a wooden pallet or in place on a solid foundation or a concrete floor. In the latter case the wooden pallet will be omitted.

Dipping Vats* A dipping vat is a necessity on a farm where hogs and sheep are raised. Cattle, horses and colts will also be benefitted by an occasional dipping. A concrete dipping vat is easily built, is permanent and when properly constructed is watertight. These advantages have made concrete a popular material for such construction.

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Although dipping vats are usually sunk in the ground, it is a good plan to have the top of the vat about 2 feet above the surface of the ground to facilitate the superintendence of the animals as they pass through the vat. It is a good plan to provide a fence around the dipping vat and a cover to prevent persons and live stock from falling into it. If it is desired to dip horses and cattle also, the vat should be made wide enough and deep enough to accommodate these animals. Sheep and hogs may be dipped in such a vat by dividing it longitudinally into two sections of equal width, by a removable fence or partition.

Hog Wallows The concrete hog wallow is an improvement which every hog raiser should consider an absolute necessity. The hogs find great satisfaction in the concrete wallow and lie down in the water, excepting in quite cold weather. The wallow proves a very practical

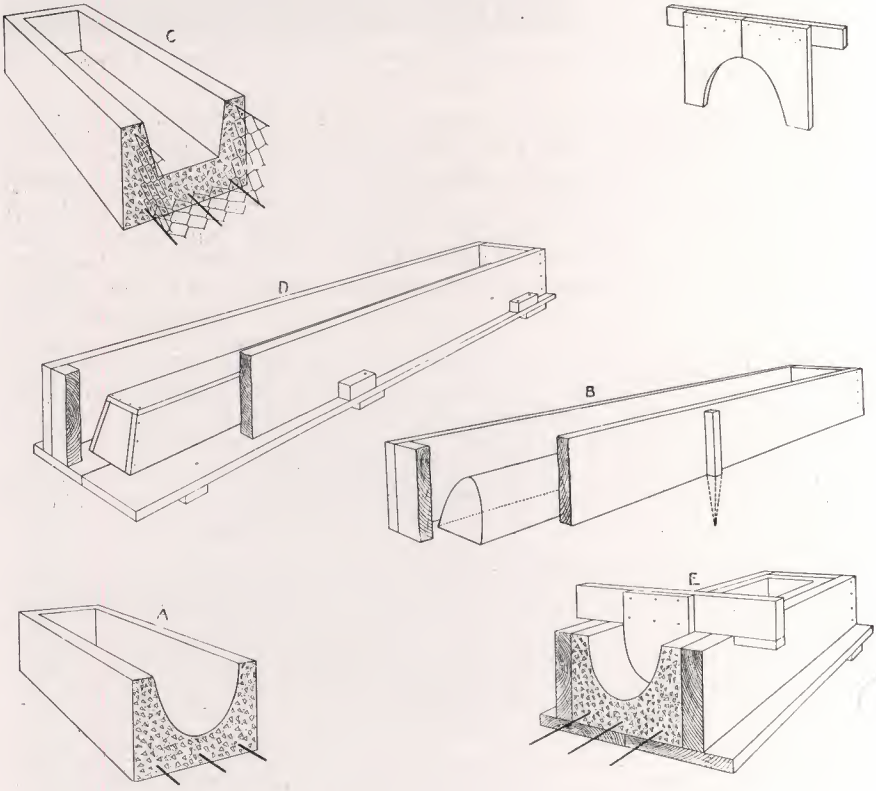

Figure 39. Concrete Hog Troughs.

scheme for killing vermin when a quantity of crude oil or other disinfectant is put in and the intake and outlet stopped. The wallow may be preferred to the dipping vat. Many farmers keep a small amount of oil in the wallow at all times, which keeps the skin of the animals in good condition. The crude oil remains on the surface of the water and therefore does not escape into the outlet.

The wallow should be located near the water supply, whether this consists of a tank or spring. If the water is received from a tank, the wallow may be emptied and refilled at intervals, the intake and outlet ordinarily being kept closed. If the supply is not limited the water may be allowed to flow through the pool continuously. Where necessary, provision should be made for draining the outlet into the nearest line of tile.

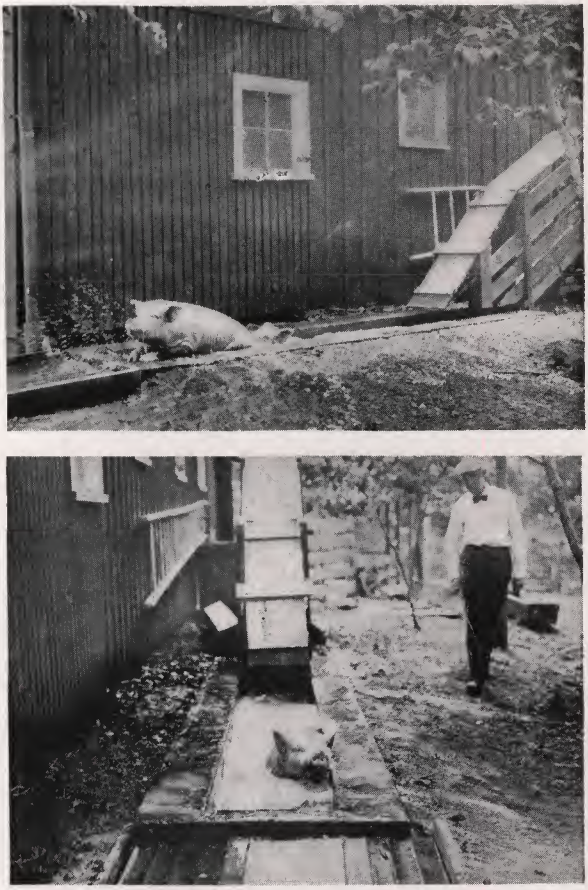

Figure 40. Concrete Dipping Vat for hcgs, on farm of F. C. Kimber, Pilot Knob, Missouri.

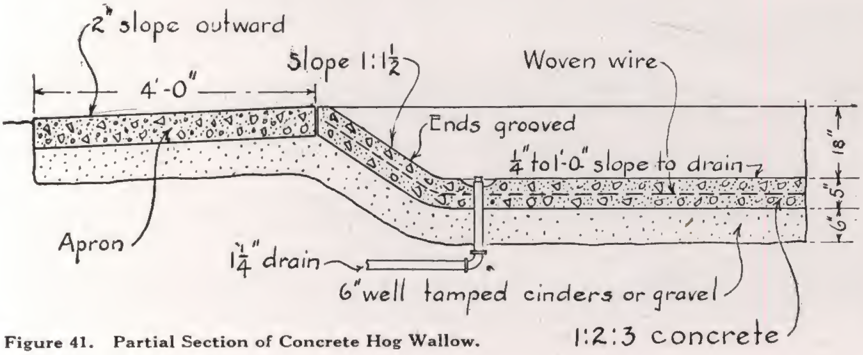

Figure 41. Partial Section of Concrete Hog Wallow.

The sectional view shown in Figure 41 gives a good idea of the general shape and construction of the wallow. It will be found convenient to make the pool rectangular with rounded corners, giving it a depth of not over 18 inches. For the ordinary piggery the pool should be 15 to 20 feet long, and 10 feet wide. A concrete floor 4 feet wide should be laid around it to prevent the hogs from burrowing or carrying in mud.

Manure Pits* By the ordinary method of piling manure on ground or storing it in wooden enclosures, 30 to 50 percent of its fertility is lost. This loss is brought about in two ways. First, by leaching or washing, due to rains and subsequent escape of moisture; second, by fermentation or heating, caused by lack of sufficient moisture. Since concrete pits are waterproof, manure may be kept in them as moist as may be necessary, and much of the enormous waste in the fertility of the manure may thus be avoided entirely. One load of manure from a concrete pit is worth from 1½ to 2 loads of manure as usually stored. However, with concrete pits the supply of manure is increased by all the liquid manure which is the richest part, and that most easily assimilated by the soil.**

If a condition whereby 30 to 50 percent of the value of the manure is lost can be corrected by using concrete pits at a low first cost it is obvious that a concrete manure pit on every farm will pay for itself in a very short time.

The manure in a roofed pit is much more valuable as a fertilizer than that stored in an unroofed pit. The roof prevents the sun's rays from

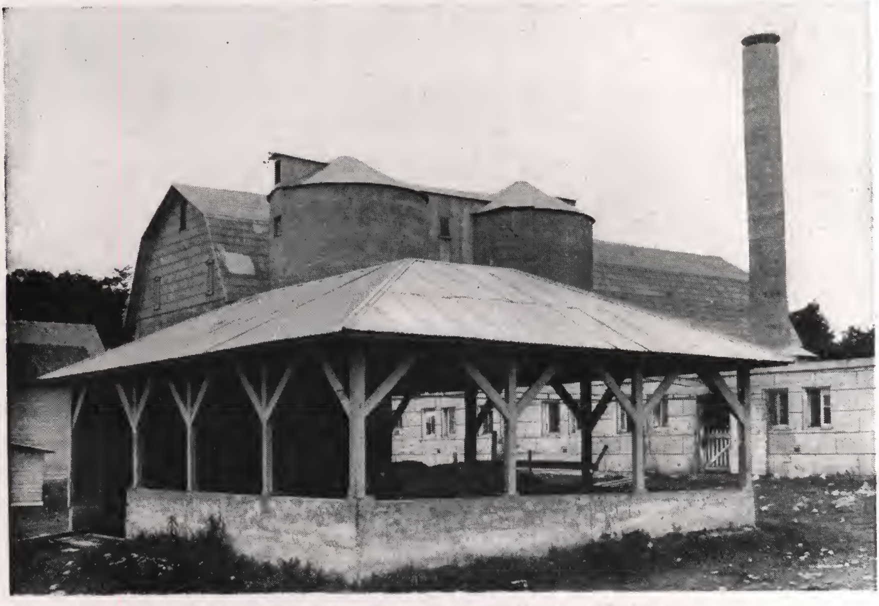

Figure 42. Covered Manure Pit, Beach Farm Dairy, Coldwater, Michigan.

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*"Concrete in the Barnyard"; distributed free by the Universal Portland Cement Co.

**From "Farmers' Bulletin No. 481" issued by the U. S. Department of Agriculture.

drying out and heating it. It also keeps rain out of the pit and makes it possible to screen it against flies.

Flies should be eliminated as far as possible, from the farm. They carry disease and filth, and irritate the stock. Dairy cows give a notably less amount of milk when tormented by them. Stock lose flesh and occasionally injure themselves because of nervousness caused by the biting of these insects. Flies breed in manure, and when the manure pit is screened a great step forward has been taken in preventing these ill effects.

Cisterns Because of the fact that concrete properly made and placed is water tight and can easily be kept clean, this material is generally employed for the construction of cisterns. It is a very good plan to purify the water before it enters the cistern and for this purpose a concrete filter-bed may be used. The filter is a small concrete tank, and the water which enters it should pass through a 6-inch layer of sand and a 12-inch layer of charcoal and then enter the cistern through an outlet pipe at the bottom of the filter. A fine wire cloth screen is placed over the outlet from the filter to keep the water from carrying sand and charcoal into the cistern. The filter should be provided with a concrete cover which may be removed and a handle should be provided in the cover slab of the cistern for the purpose of cleaning. The supply pipe should be placed a sufficient distance below the surface of the ground to prevent freezing in the winter months.

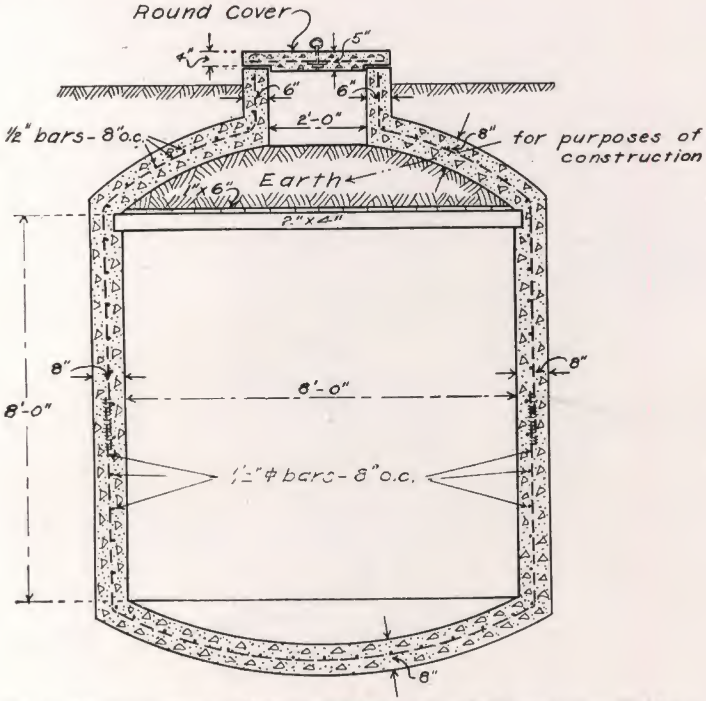

Figure 43. Diagram Showing Method of Placing Concrete Arch Top on Cistern.

Arched Cistern Top* It is necessary to provide a wooden form for the arched top. All that is needed is to place 2x4s across where the arch begins and lay a light floor on top of these 2x4s. Pile moist earth on top of this floor and pack it firmly to form the shape desired. Then place the concrete for the arched ring reinforcing as shown in Figure 43. The box forms for the top should then be placed and the top built up. When the concrete has hardened sufficiently the earth and timbers may be removed through the top.

Septic Tanks for Farm Residences A sewage system with septic tank is a great convenience for the farm residence, and in addition safe guards the health of the family. Reinforced concrete septic tanks are easy and inexpensive to build and may be so constructed as to require no attention whatever, except an annual cleaning. The septic tank shown in Figure 44, if built and operated properly, will be sufficient for the sewage from a family of moderate size.

Baffle boards are placed in the settling or purification chamber to break up all currents in the sewage as quickly and completely as possible. One of these baffle boards also retains the surface scum in the purification chamber.

The organic solids are broken up in the purification chamber into liquids and gases by bacterial action, but much of the mineral matter is

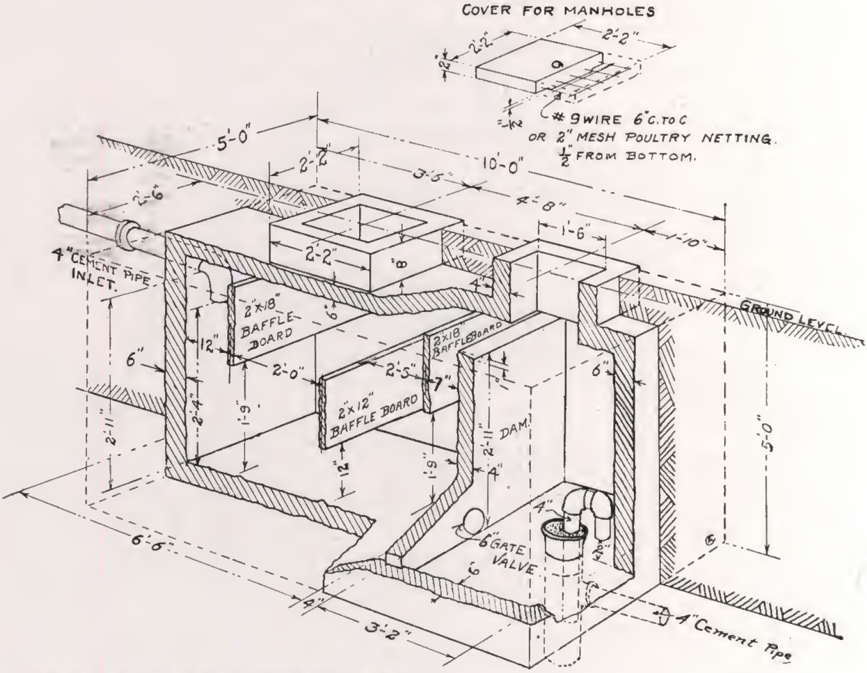

Figure 44. Design for a Concrete Septic Tank.

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*Adapted from letter written by R. C. Sabin, Ludington, Michigan.

deposited on the bottom of this chamber. The liquid flows over the concrete partition wall into the discharging chamber. The outlet as shown in Figure 44 provides for an automatic intermittent discharge. The intermittent discharge flushes the outlet drain with a volume of liquid, and is therefore much more desirable than a continuous discharge.

The tank should be cleaned of sludge and scum about once a year and manholes are provided for this purpose. The settling chamber may be emptied through the valve provided in the partition wall, the sludge and scum passing off through the discharge pipe.

Waste Water Receptacles Figure 45 shows a catch basin and a very simple way of building it. A part of an old barrel serves for the inside form, and the earth walls of the excavation for the outside form. In constructing the basin, first lay the 4-inch elbow and the adjoining pipe for the outlet. The drain can be finished after the catch basin is completed. The excavation for the catch basin should be made carefully so that the side walls will serve as an outside form for the basin. The excavation should be circular and of such size that there will be at least 4 inches between the walls of the excavation and the outside of the barrel.

The concrete for the bottom will be deposited first and should be abcut 6 inches in thickness. In order to have the basin drain rapidly, it is advisable to give the bottom a decided pitch to the center; this can be easily accomplished by working it into shape with a trowel. Place the barrel in position in the newly formed bottom and deposit the concrete for the walls. Care must be taken to keep the barrel in place, so that the walls will be of uniform thickness. If it is desired to have an underground inlet pipe enter the basin, provision for this must be made before depositing the concrete for the walls. The cover consists of a circular slab 3 inches thick, and reinforced with 2-inch mesh

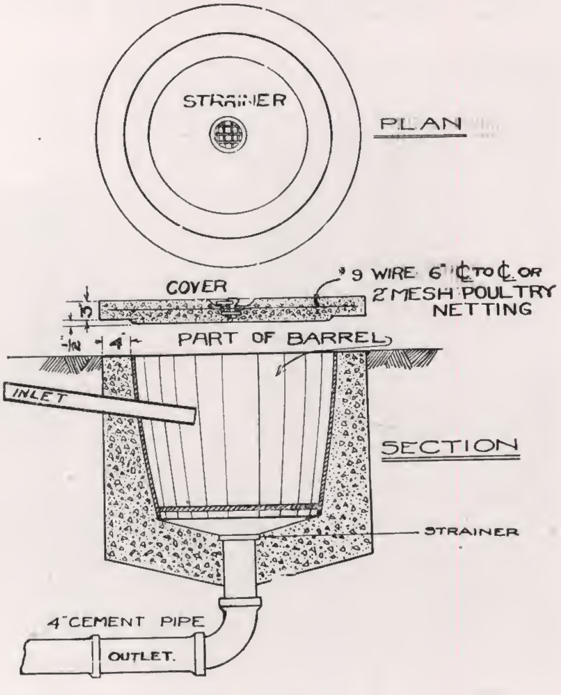

Figure 45. Waste Water Receptacle.

poultry netting or lengths of No. 9 wire, spaced about 6 inches center to center and running in both directions.

Concrete Silos* A concrete silo is rat-proof, wind-proof, fireproof and permanent. It will not dry out in the hot summer months, and require constant attention to prevent its falling to pieces. It keeps silage perfectly, and can be constructed at a moderate first cost. For these reasons it is the most economical type of silo to build.

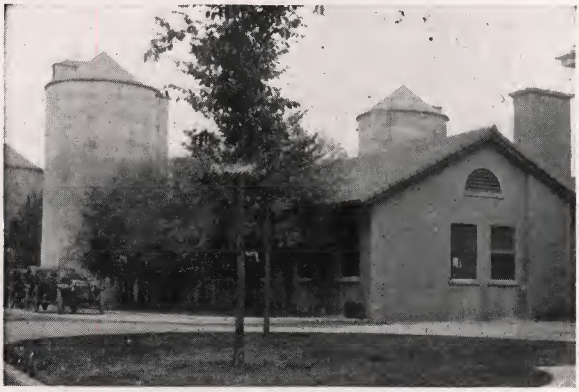

Figure 46. Monolithic Concrete Silos and Dairy Barn, Arcady Farm, Lake Forest, Illinois.

There are four types of concrete silos, monolithic, block, cement stave and cement plaster construction. Some of these types are illustrated in Figures 46 to 51. The monolithic concrete, concrete block and cement plaster silos have often been built by farmers with the help of ordinary farm labor only, but it has generally been found more convenient and

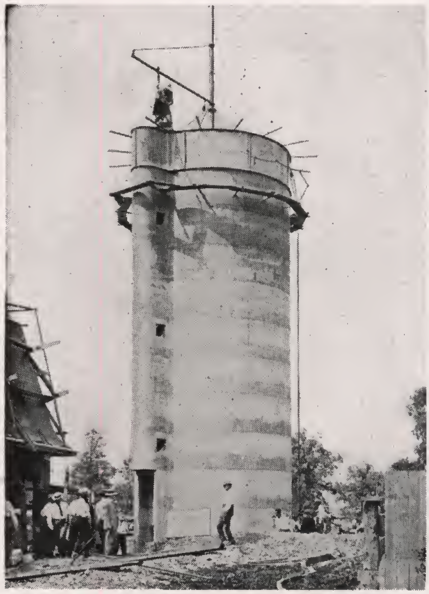

Figure 47. Monolithic Concrete Silo under construction at Kane County, Illinois, Poor Farm. W. H. Warford, Builder.

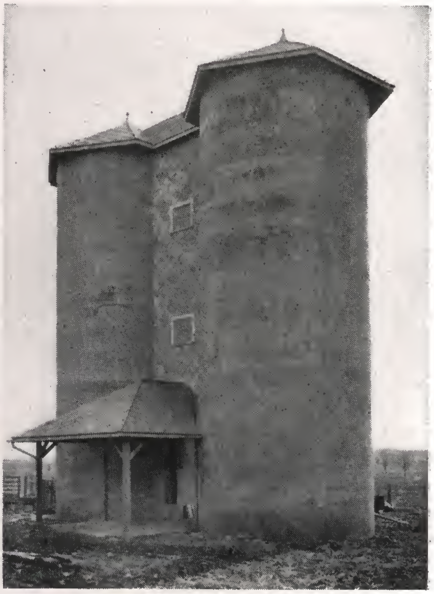

Figure 48. Twin Monolithic Silos at U. S. Department of Agriculture Experiment Farm, Beltsville, Maryland. Cement asbestos shingle roofs and chute.

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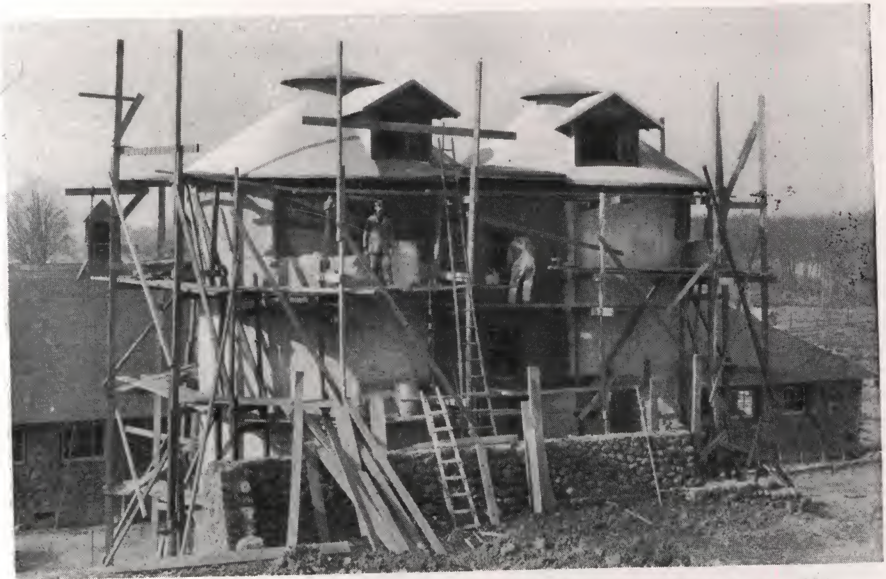

Figure 49. Cement Plaster Silos, Walker Smith, owner, R. F. D. No. 3, Youngstown, Ohio

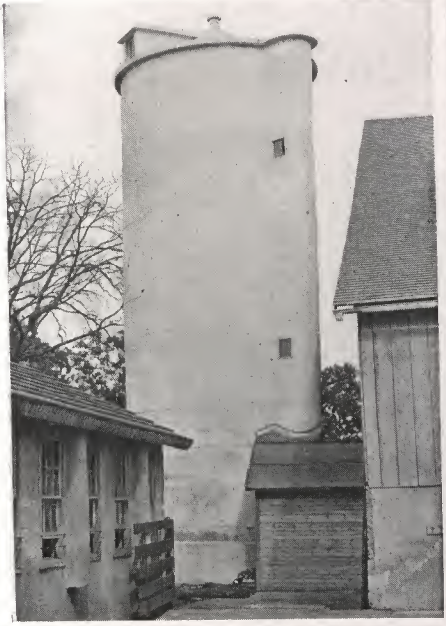

Figure 50. Monolithic Concrete Silo with concrete roof and chute, Hartwood Farms, Barrington, Illinois.

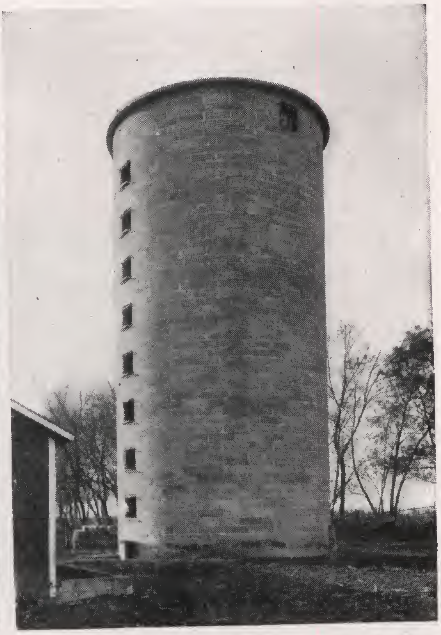

Figure 51. The Anchor Concrete Block Silo of Chas. Cline, Rock Rapids, Iowa.

satisfactory to let the work to some reliable contractor. Cement stave silos are always built under contract.

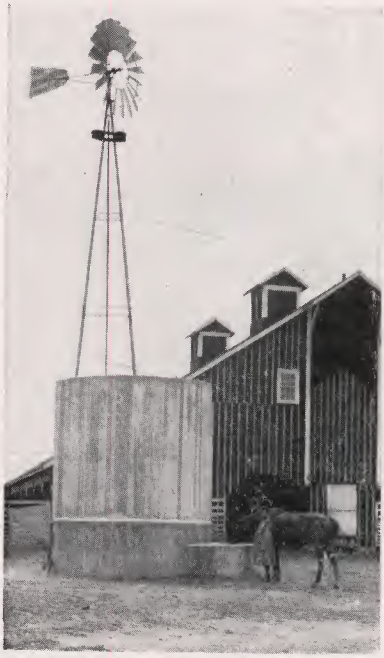

Figure 52. Round Concrete Storage Tank on the farm of Col. Thompson, near Mexico, Missouri.

If the farmer prefers building his own concrete silo, the monolithic type will be, in most cases, the easiest and most satisfactory to construct. Co-operative farmers' clubs are often formed in a neighborhood. Steel forms are procured and the materials Portland cement, sand, gravel and reinforcing, purchased in carload lots, and the hauling divided. In this manner the cost can greatly be reduced.

Water Storage Tanks Concrete is often used in the construction of a storage tank to supply water under pressure for all purposes, on the farm. A very good plan is to place a tank on top of the concrete silo, when building this structure, but where this cannot be arranged, the storage tank can be built as shown in Figure 52. Such a tank should rest on concrete foundation walls as high as the highest level where water is needed. It should be set on a small hill if possible.

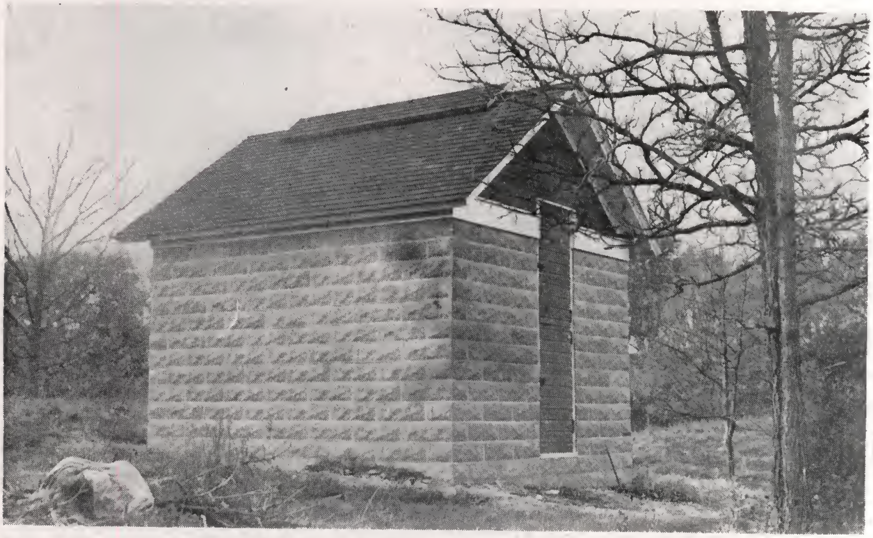

Figure 53. Concrete Block Ice House, built of rock faced blocks on the farm of Mrs. Gallup, Rochester, Wisconsin.

Concrete Building Blocks*

Judging from the demand and from the variety of uses to which it is put, the concrete block is the most important of all cement products. When properly made it has not failed to give satisfaction as a building material and much of its popularity in farm communities is due to the fact that it can be made from local materials by ordinary farm labor. Concrete blocks properly made at a cement products plant are generally superior to home-made blocks and it will be economical to buy rather than make them, where only a few blocks are to be used. However, if blocks cannot be conveniently purchased or a large number are required, the farmer should not hesitate to manufacture this product, for with due care and the necessary equipment good blocks can be made at home.

Concrete block construction offers many advantages. The hollow blocks make a saving of about one-third of the material, without reducing the strength so as to impair the safety of the structure built with them in any way. Facings can be used which give attractive effects but these should not affect the use of a good, watertight mixture in the body of the blocks. In addition to the well known fire resisting qualities of concrete, the blocks also have the advantage of the interior air chambers, which allow them to conduct heat or cold but slowly. This fact makes buildings of this material "warm in winter and cool in summer," and tends to prevent sweating of the walls. A type of block which deserves special note is that having a continuous air chamber providing perfect insulation between the two faces of the block.

Concrete for the body of the blocks should be mixed in the proportion of 1:2½:4. The particles of screened gravel or broken stone should vary in size from ¼ of an inch to ¾ of an inch in their largest dimension. As much water should be used in mixing as is possible with the type of block mold used. As a usual thing, block molds do not permit the use of as wet a mixture as is desirable, but best practice requires the use of as quaky a mixture as possible.

Several types of metal block molds have been placed on the market which allow the use of a wet mixture. This is a great advantage but on account of the large number of gang molds that must be used in the casting of such blocks, it can hardly be considered economical for farm use. Where a facing is desired on the concrete block, it is usu-

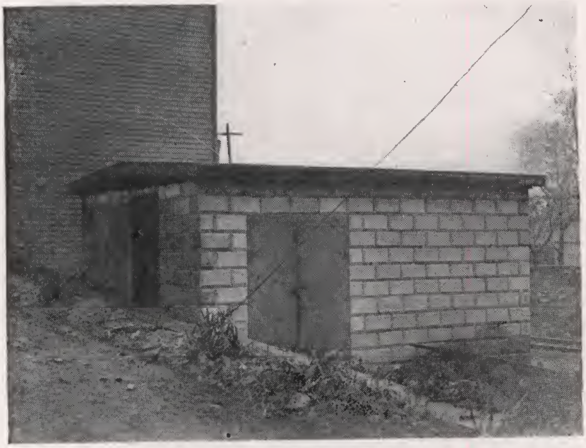

Figure 54. Concrete Block Pump-House at Cropsey, Ill., showing the type of wall surface obtained by the use of beveled face blocks.

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ally given by placing a half-inch mortar coat in the mold and then filling the mold with concrete. Colored sand is often used to color the mortar facing and sometimes mineral coloring matter is added for the same purpose.

The curing of concrete blocks is one of the most important points in their manufacture and it is the one which is probably most often neglected. Carelessness in curing is likely to undo all that has been previously accomplished by careful proportioning, mixing and forming. In moving blocks from their place of molding to the storage place, care should be taken not to subject them to any shock, for a crack once started will always have a tendency to lengthen during the time of hardening. After the blocks are about 24 hours old, they should be covered with straw or hay and should be protected from wind, sunlight and dry heat to prevent rapid drying. They should also be sprinkled thoroughly twice daily for at least seven days. After this time, they should be drenched frequently until they are 30 days old, and no block should be used until it has been cured in this manner.

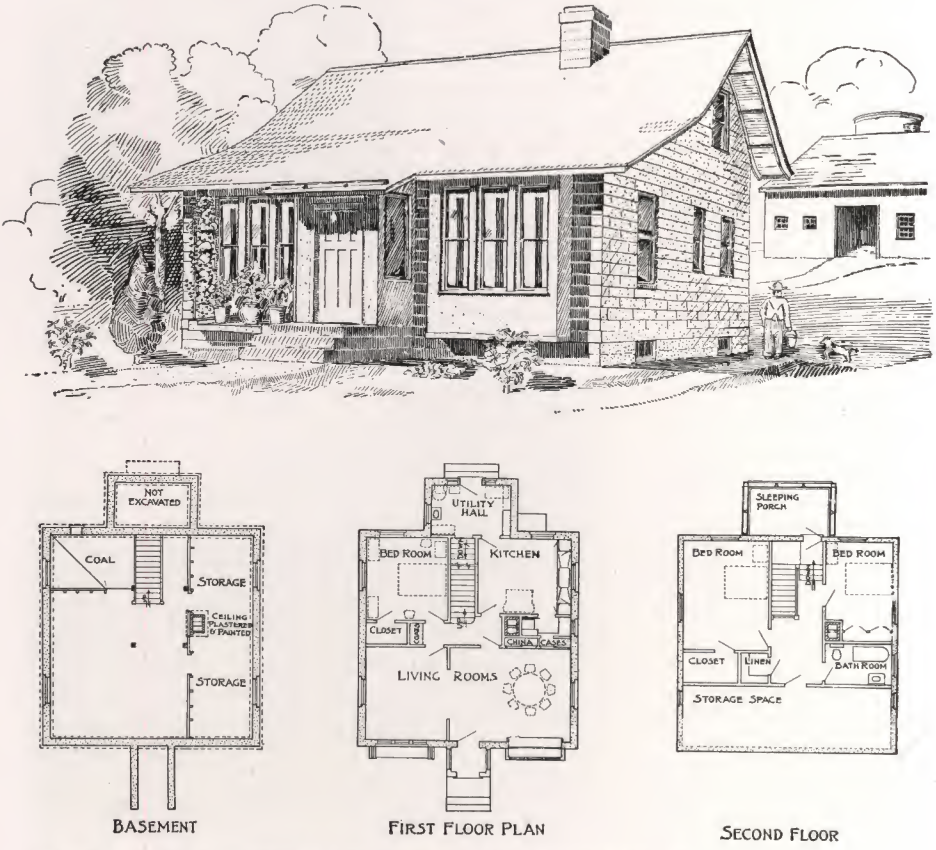

Figure 55. Plan and Design for a concrete block farm house of low cost.

Farm Buildings

Residences

The five log houses of Plymouth, built by the Pilgrim Fathers nearly three centuries ago were probably the first substantial buildings constructed by white men in America. While timber was plentiful the log house was logical. Next came sawed lumber and frame dwellings but with the present prohibitive price of lumber and its diminishing supply, some substitute must be used.

In these days when concrete plays such an important part in farm building, it is only natural to extend its use to the farm residence. Thus the farm house is often built of one of the types of concrete construction—block, monolithic or stucco. With any of these types an attractive appearance can be obtained and the structure will at the same time, be economical and durable. The design shown in Figure 55 is one which under average conditions can be built for $2000, including heating and plumbing. It is in no sense a cheap house, but has good lines and is particularly planned for a farm dwelling. The "Utility Hall" holds the milk cans and the sundry articles that are otherwise brought in to the kitchen; the cellar entrance is handy; each bedroom has ample closets; and there is a large storage space under the roof.

A full second story can be built with little extra expense, thus utilizing the storage space for another room and giving an attic above. This residence was designed to have its walls built of cement blocks with an air space. The inner wall surface should be furred and plastered and the outside needs no treatment. Walls can also be constructed of monolithic concrete or stucco with good results. It is taken for granted that a water supply may be obtained from an elevated tank, which is not unusual today among progressive farmers. The upstairs sleeping porch should be just as much appreciated in the country as in the city where they are verycommon.

This design was prepared by A. A. Pollard, Architect, of Minneapolis.

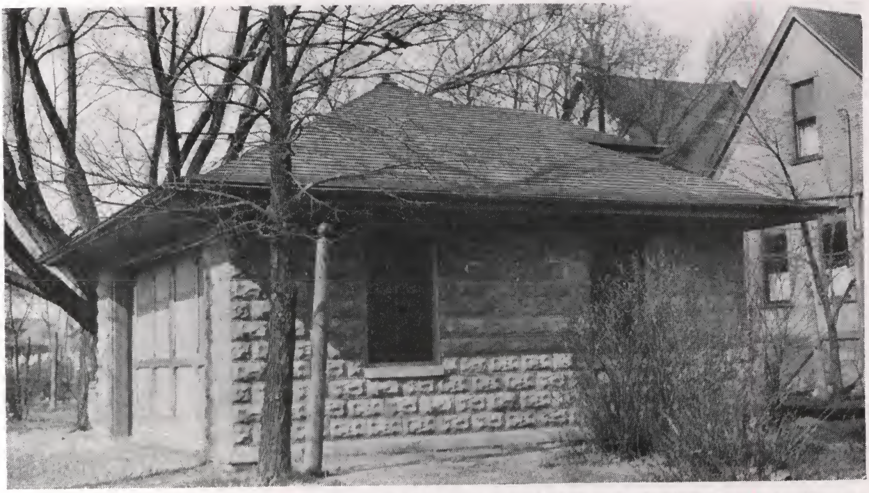

Figure 56. Private Garage built of concrete blocks, E. Hosler, owner, Forest Park, Illinois.

Garages*

With the rapid increase in the percentage of the automobiles manufactured in this country which are sold in the rural districts, there is an increasing interest in the construction of small private garages. The farmer who has worked with concrete will undoubtedly wish to use it in some form for the construction of the garage, for it is important that this building be built of fireproof material.

Figure 57 shows a plan of a monolithic concrete garage suitable for private use. The walls should be 6 inches thick, except at the corners, where the thickness is increased to give the effect of pilasters. If concrete blocks are used in the wall (see Figure 56) the thickness would be increased to 8 inches to accommodate the standard block, which is 8x8x16 inches in size. The foundation under the walls proper should be about 12 inches in thickness and should extend to a solid sub-soil, below the frost line.

In order that the structure may be entirely fireproof, this building should not only have concrete walls but a flat concrete roof as well. The roof slab should extend beyond the walls a short distance to give a pleasing effect and the whole roof should be given only a slight pitch from front to rear to provide for drainage.

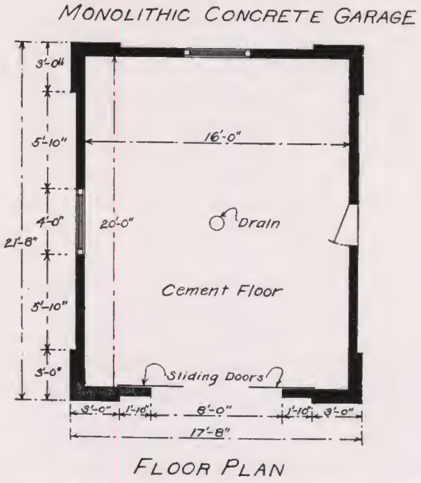

Figure 57. Plan for a Small Monolithic Concrete Garage.

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*For further information on concrete garages address the Information Bureau Universal Portland Cement Co., Chicago.

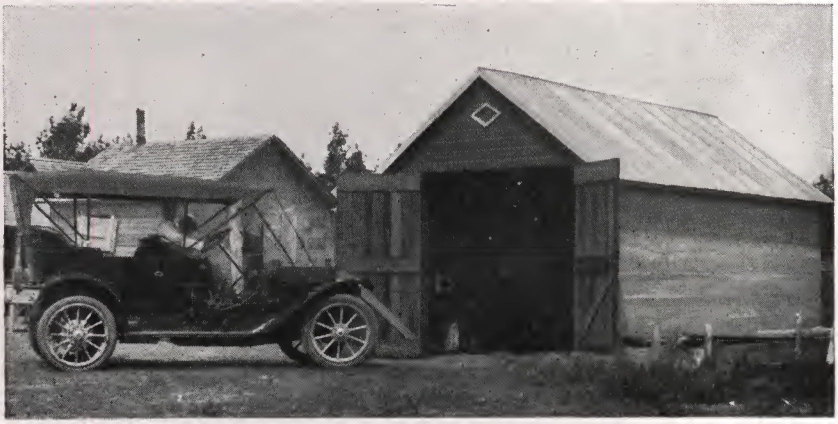

Figure 58. Monolithic Concrete Garage of A. R. Fryer, Doland, South Dakota.

Barns

The use of concrete in barns and stables has generally been limited up to the present time, to foundation, floor and wall construction. There are, however, many stables and barns in different parts of the country for which concrete has been used throughout. The great difficulty has been that it required a man experienced in concrete work. Farmers generally, are familiarizing themselves more and more with the use of concrete, and will be able, at no far distant date, to undertake the construction of such a building. Indeed some have already constructed similar buildings with entire success.

There is no doubt that concrete has decided advantages as a building material for a barn or stable. It is sanitary, permanent and fireproof. It has a low first cost and makes a building that is easily maintained at a uniform temperature throughout all seasons of the year. Moisture occasionally collects on the walls of the stables, but dampness is very often a sign of poor ventilation and where a proper system is employed there should be no condensation on the inside of such walls. Fortunately the amount of air required for a healthful condition of breathing is in excess of that necessary to remove the moist air. Many builders prefer double walls in concrete stables, and such a wall will give added insulation against heat and cold. The concrete hollow block wall is probably the most commonly used but monolithic walls furred, lathed and plastered on the inside have also given excellent satisfaction.

A few years ago even our more progressive farmers were inclined to doubt the practicability of an all-concrete barn, but the fact that of late several have been constructed and are in successful operation is a conclusive indication of their growing popularity.

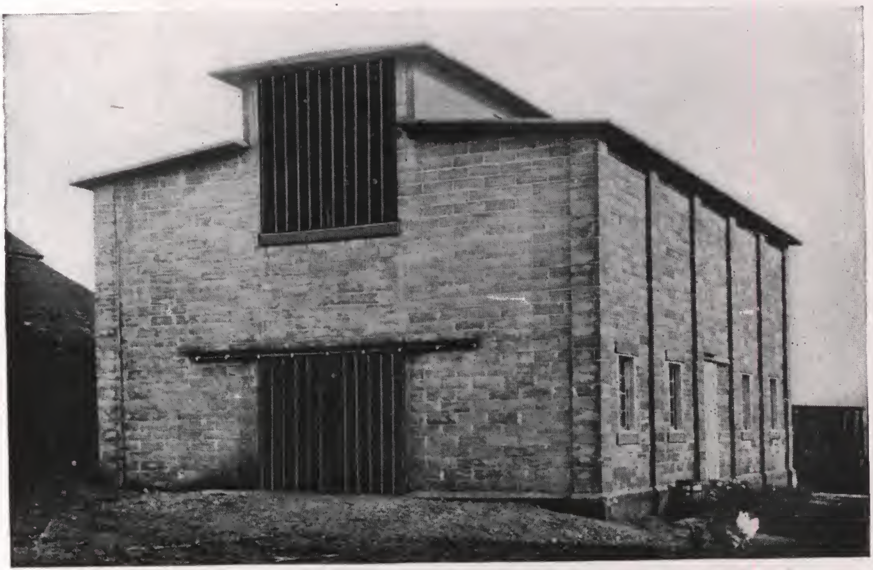

Figure 59. All concrete barn of A. J. Fowler, Sheridan, Illinois, built with reinforced concrete floors and roof, costing less than $2600.

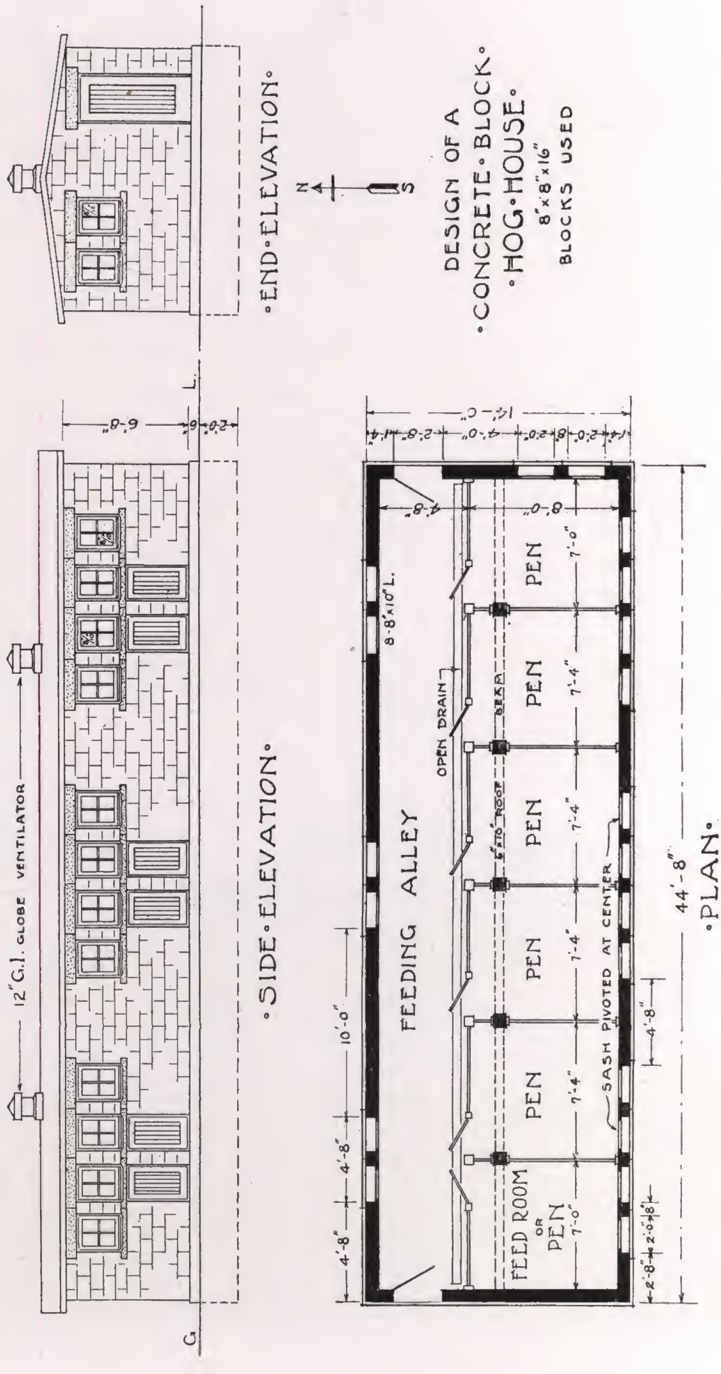

Figure 60. A Five Pen Hog House of concrete blocks.

Hog Houses*

The introduction of concrete in and about the hog house has been productive of excellent results, both by improving the conditions under which the swine are housed and fed and by making possible a saving in labor, maintenance expenses and feed. Recent government bulletins on hog tuberculosis point clearly to decaying wood construction as a chief source of infection.

In the Corn Belt States, especially, concrete floors are replacing wood for both sanitary and economical reasons. The manure, particularly the liquid manure, is saved on the concrete floor by bedding, or else by being drained into a gutter and to a manure pit. Concrete floors are easily kept clean and are readily and cheaply disinfected. All-concrete hog houses are very desirable because of their freedom from vermin, the fact that they can be easily disinfected and that they are dry and warm, affording protection from the cold in winter and the heat in summer. No other animal but the hog wears his summer coat in winter, and therefore no other domestic animal needs so much protection, contrary perhaps, to popular belief.

The concrete hog house should not have any sharp edges but the corners should be rounded and the floor should be pitched to a drain.

The house shown in Figure 60 is designed to shelter a small number of sows with winter litters. It has concrete block walls and a reinforced concrete roof, supported by concrete beams and columns. Drainage for the concrete floor has been provided and the ventilating system supplies plenty of fresh air without compelling the hogs to lie in a draft.

The wall blocks, as well as the concrete window sills and lintels, may be purchased from the nearest dealer or made on the place. The window and door framing is simple and may be executed by any carpenter.

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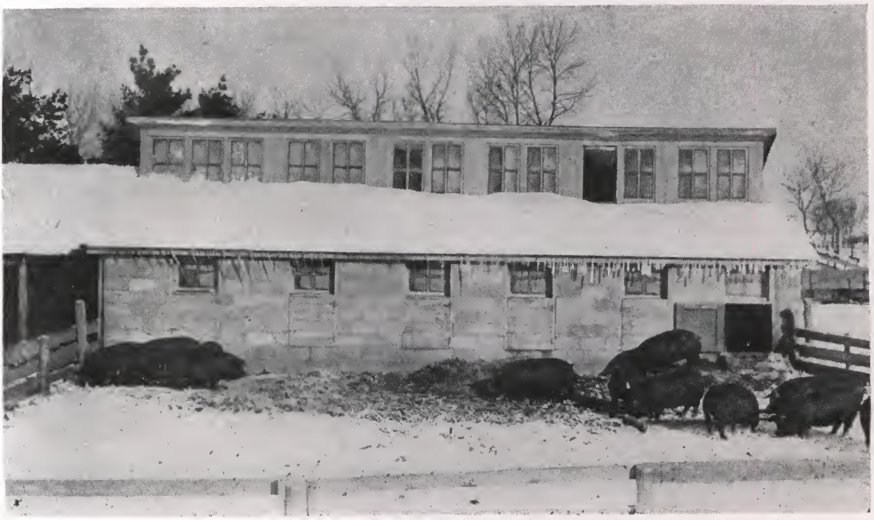

Figure 61. Concrete Block Hog House, Beck Bros., Early, Iowa.

Poultry Houses*

If the walls, roof and floor of a poultry house are constructed of concrete there is no place for vermin to harbor and therefore, such construction is very desirable. In addition, concrete is easily cleaned and provides a house that is cool in summer and easily kept warm in winter.

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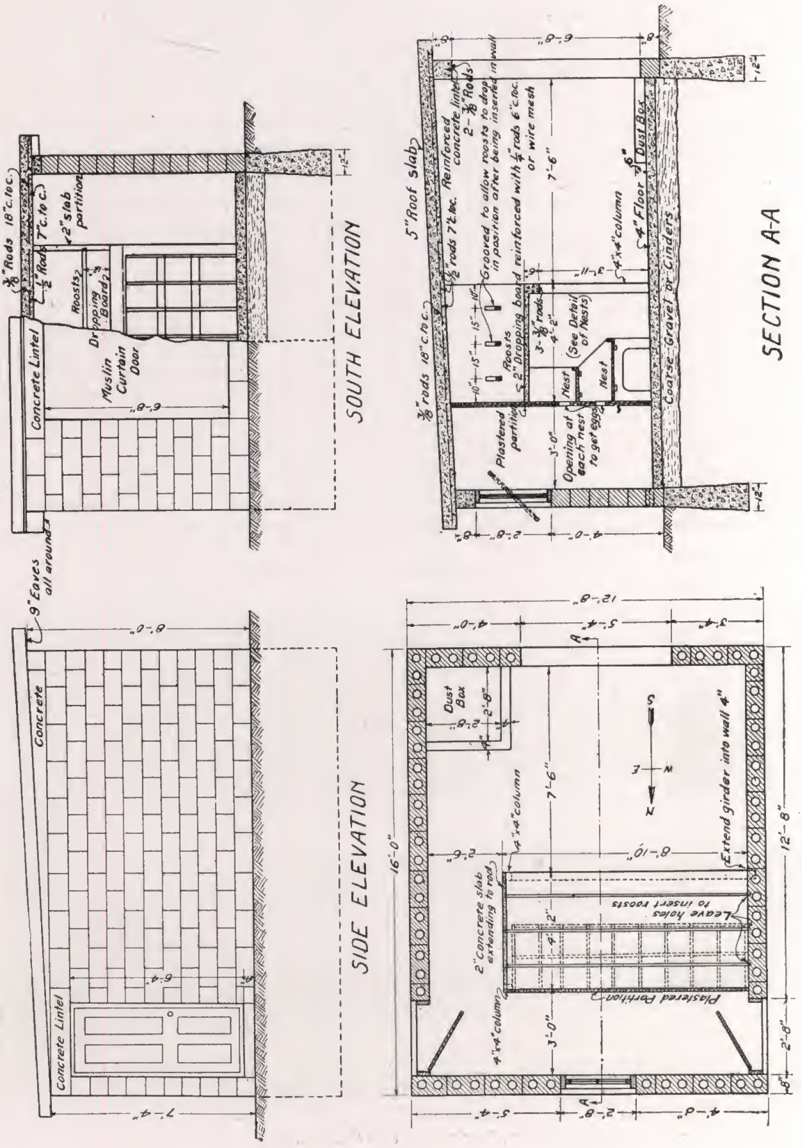

Figure 62. Design for Concrete Block Poultry House, which may be enlarged by duplicating the structure shown.

In these days of back-to-nature and open air poultry houses—the concrete house presents unusually desirable features. Poultry can withstand dry cold when housed, but cannot endure dampness or drafts from below. Every poultry house should have a cement floor. The old wooden floor not only allows rats to enter but is a source of dangerous drafts and a constant menace to the health of the poultry, because of its being a refuge for vermin. Concrete floors are used on some of the largest commercial egg farms and by some of the most successful poultry breeders in the United States, which is proof-positive of their efficiency.

In putting up a poultry house, the owner frequently has in mind future additions or alterations to give the house greater capacity. The concrete block building shown in Figure 62 is designed to accommodate a flock of thirty-five or forty chickens, but is so planned that it may be enlarged to accommodate any number of birds desired, by simply adding rooms of the same size on either side of the structure.

The poultry compartment is 11 feet 8 inches from the hallway to the front of the building and 12 feet 4 inches from side to side. The hallway is divided off from the poultry compartment by a cement plaster wall. Light and ventilation are provided in the poultry compartment by a large window in the front, 6 feet 8 inches in height and 5 feet 4 inches in width. The window should swing on a vertical axis or from hinges attached to the top of the frame and should be covered with heavy muslin or light canvas.

Two doors are shown leading into the house from the outside but only one is required if just a single section of the house is built. If more than one section is built it is convenient to have a door at each end of the hallway.

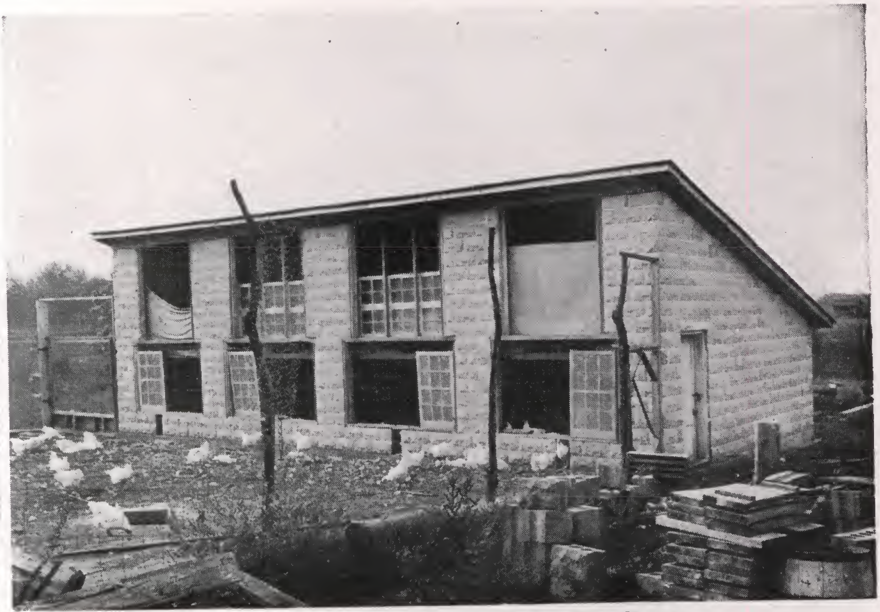

Figure 63. Concrete Block Chicken House of H. Cox, Farmer City, Illinois.

Milk Houses*

The first requirement of a milk house is that it be scrupulously clean. There should be no decaying wood construction to serve as a breeding place for germs and no cracks or crevices in the floor or walls to collect dirt and make proper cleaning difficult or impossible. A house properly

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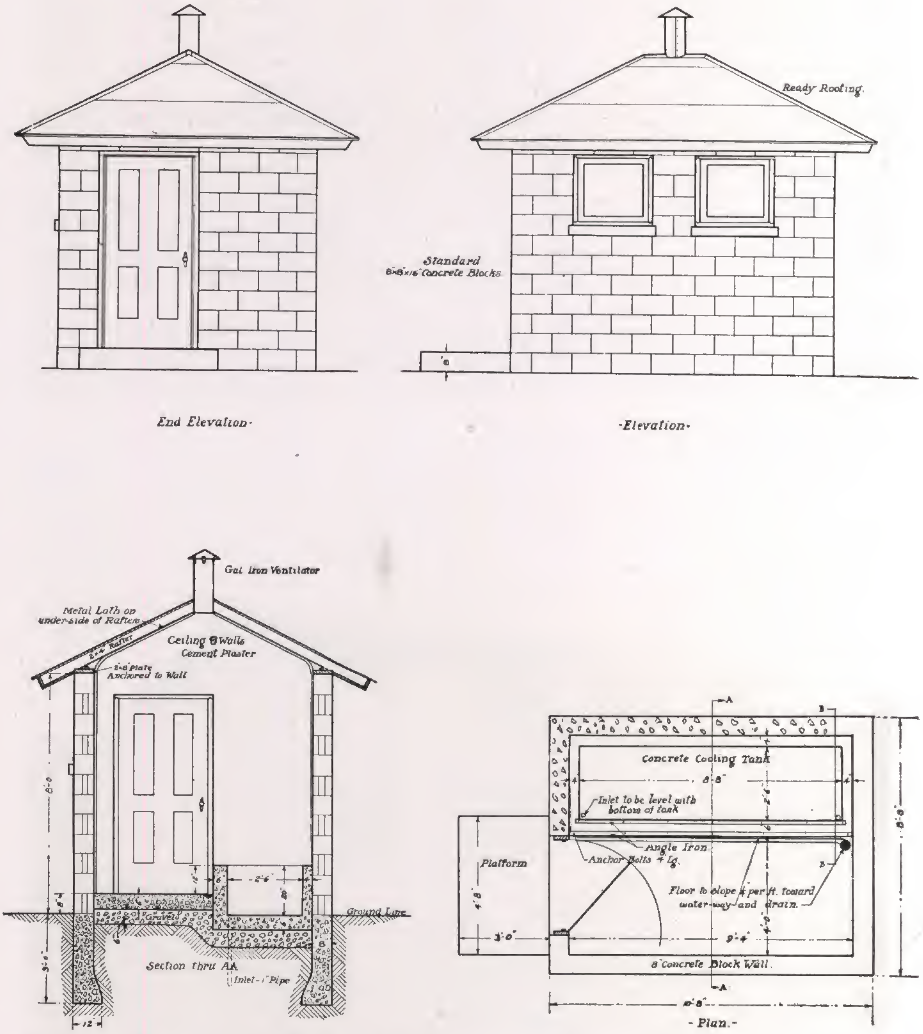

Figure 64. Small Concrete Block Milk House.

constructed of concrete fulfills these requirements and this material is in general use for the construction of such buildings.

The concrete floor is necessary in any type of milk house for sanitary reasons. It should be trowelled quite smooth, with a pitch toward the center, where an adequate drain should be located. The question of good drainage is important as unless the milk house can be quickly and easily cleaned and disinfected, odors will develop, which may spoil and possibly ruin the milk for commercial purposes.

The milk house should be carefully located with reference to other buildings, such as stables and manure pits. The New York law, for example, requires, for certified milk production, that the milk house should be at least one-hundred feet away from such buildings. One easy way to keep the milk house in good condition is to have a cement walk above grade leading to the dairy barn.

The concrete block milk house shown in Figure 64 is designed to meet conditions where a small house is desired. It is equipped with a cooling tank, but has no ice room. This structure is 10 feet 8 inches x 8 feet 8 inches in outside dimensions and is made of standard 8x8x16-inch concrete block. The cooling tank is 2 feet 6 inches x 8 feet 8 inches in inside dimensions and has a capacity of fourteen 14-inch cans. A wooden roof frame should be covered with cement shingles or ready roofing, the former being superior to the latter because of their permanence and fire resisting properties. Metallic lath should be attached to the under side of the roof and the ceiling plastered. It will also be a good plan to plaster the inside of the block walls. The surface of the plaster should be made smooth and all corners should be rounded so that it may be easily washed down and kept sanitary.

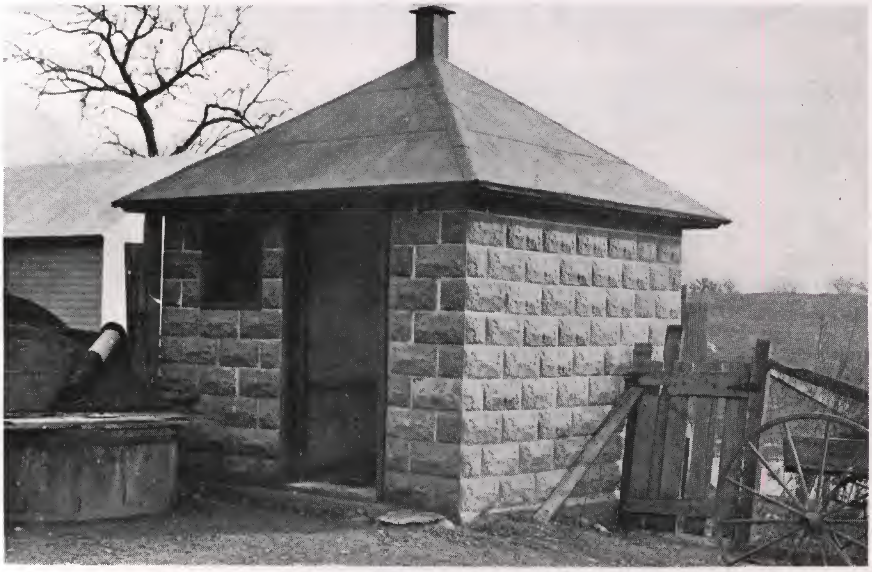

Figure 65. Small Concrete Block Milk House of Theodore Alby, Burlington, Wisconsin.

Ice Houses*

A wooden ice house is usually an unsightly structure after it has been up for a short time, for it is generally warped and out of shape and the sills and lower timbers decay rapidly from the dampness caused by the melting of the ice. A concrete ice house is a good investment because when properly constructed it will last for an indefinite period and will not warp out of shape, blow down or be destroyed by fire. The additional expense of concrete construction, if any, will be entirely compensated for during the first few years by the lower cost of up-keep.

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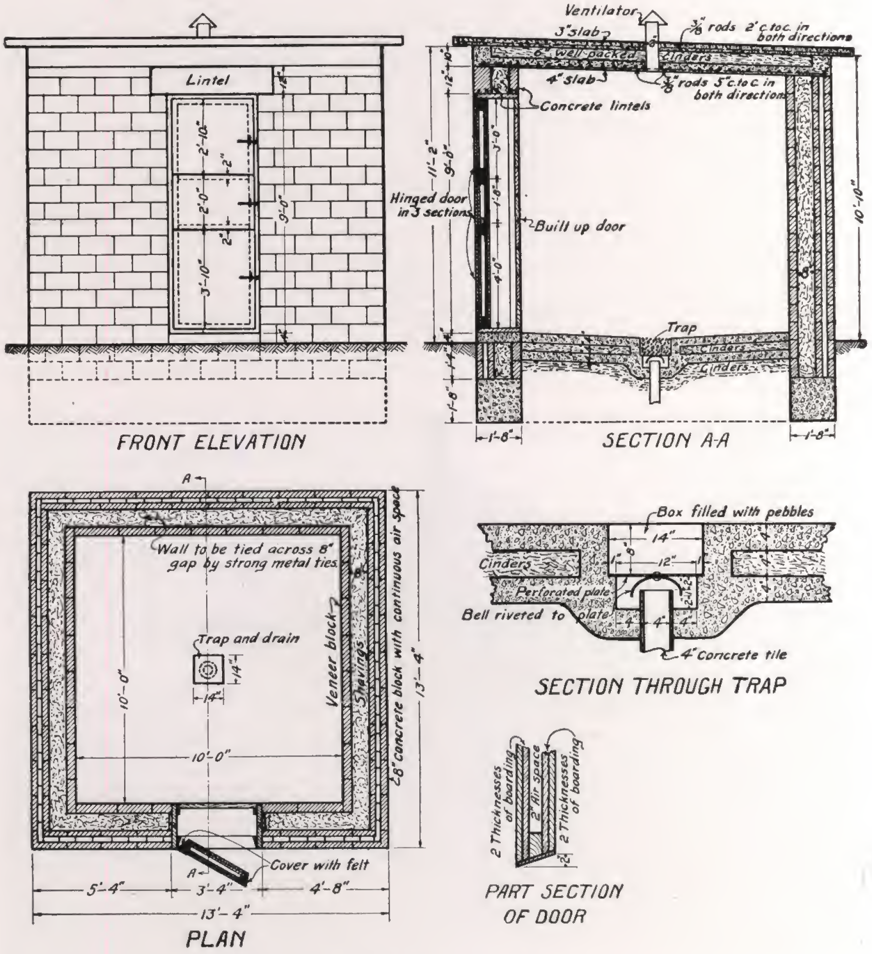

Figure 66. Concrete Block Ice House. Walls have double air space.

Figure 66 shows the design of a small concrete block ice house with walls having two air spaces. The inside dimensions of the building are 10 feet square by 10 feet in height and it will hold from 15 to 20 tons of ice.

The walls consist of an inner wall of solid veneer block, 4 inches thick, and an outer wall of 8-inch hollow block There is an 8-inch air space between the two block walls. For maximum efficiency the hollow blocks should be of the continuous air space type. The inner and outer walls should be tied together with metal ties, made of strap iron or similar material, at frequent intervals. The space between the two block walls should be filled with ground cork, dry shavings or sawdust. Dry shavings probably make the cheapest and most satisfactory insulator. The joints between blocks should be well flushed with mortar in order to prevent the penetration of dampness and a coating of tar or pitch upon the side of the wall next to the insulating material is advisable to keep it dry.

The floor is double, each layer being constructed of single course type. It should rest upon a 6-inch layer of gravel or cinders. The two 4-inch layers of concrete are placed upon this sub-base with a layer of cinders between, as shown in Figure 66. The floor should slope toward the drain in the center. The trap shown in the figure is necessary to prevent a circulation of air up through the ice. The design shown is simple and no part of it will rust except the plate and bell, which are both removable. The box opening is made with a wooden box form and a 4-inch concrete tile should project about 3 inches through the bottom in the center. The plate, which is about 14 inches square, is perforated to permit water to pass through. The bell which hangs over the top of the tile when in position, is riveted to the center of the plate. Water will then stand in the box to the level of the top of the tile, effectually sealing the drain. The space above the plate should be filled with pebbles or broken stone. The roof consists of two concrete slabs with a layer of cinders between.

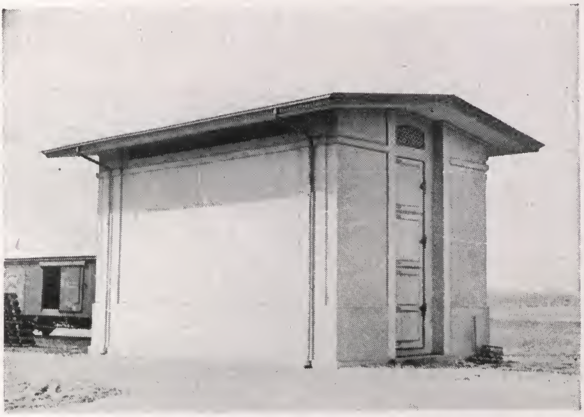

Figure 67. Small Ice House with Concrete Roof, Armour Farm, Lake Forest, Illinois.

Root Cellars*

In most of the Northern states root cellars are commonly used for the storage of potatoes, turnips and other vegetables from the time of gathering until marketed. In this way the farmer is enabled to take advantage of the high prices which usually exist some time after the crop is harvested.

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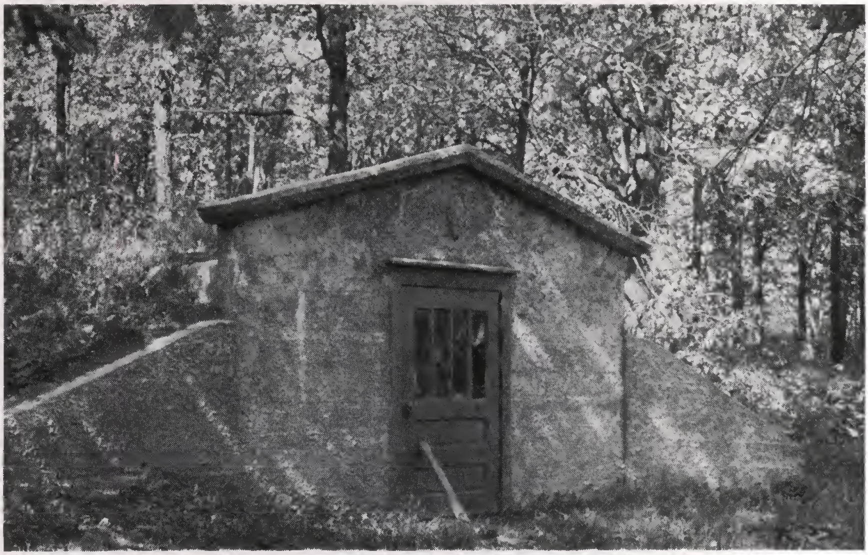

Figure 68. Monolithic Concrete Root Cellar, University Farm, St. Paul, Minnesota.

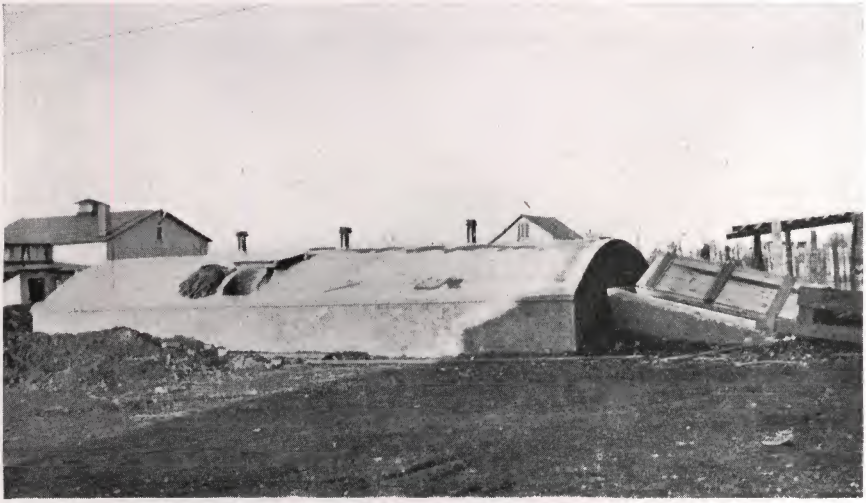

Figure 69. A Concrete Root Cellar on Iowana Farm, near Davenport, Iowa. This cellar has a reinforced concrete arched roof.

Such cellars are also used for the storage of fruit. Roots for the winter feeding of cattle are also stored in such cellars.

Such cellars are often built entirely below the surface of the ground like the one shown in Figure 68. Sometimes the root cellar is built only partially below the surface of the ground; thus the root cellar shown in Figure 69 is designed to have only the side walls below ground level. In either case, however, it is a good plan to build the root cellar of a material that will not rot and require constant expenditure for repairs.

The concrete root cellar shown in Figure 68 consists of a rectangular room or cave with wing walls extending across the front to retain the fill around the structure and prevent it from working down around the doorway.

The root cellar shown in Figure 69 is considerably larger in size. Ventilators are provided in the roof to provide a circulation of air and the roof has openings in it near the side walls which are used for filling the cellar.

Machine Sheds*

It is a well known fact that the farmers of this country are extremely negligent when it comes to the matter of protecting their farm implements. Even the largest and most expensive pieces of machinery, such as harvesters and traction engines are frequently seen standing out exposed to the weather, resulting in an enormous annual loss through depreciation. If farm machinery is kept in a good, dry house, and other-

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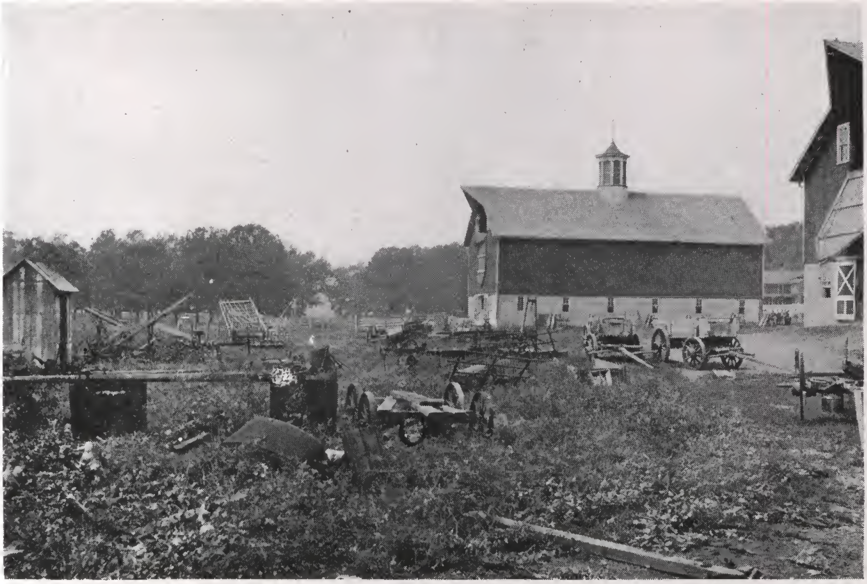

Figure 70. Needless waste on an otherwise well regulated farm. Over 10 valuable pieces of machinery exposed to weather rust and damage.

wise cared for when not in use, it is no exaggeration to state that its period of usefulness can be increased to three or four times that when left exposed to the weather.

Occasionally space is provided in the barn for the storage of implements, but in most cases room for storage purposes is at a premium and the arrangement of the barn makes it necessary to frequently move stored implements from one location to another in order to facilitate the work. This, as well as other considerations, make it desirable to store all machinery, tools, etc., in a building especially designed and built for the purpose. The size and shape of the implement house should conform with the number and size of the objects to be stored. For this reason, it is difficult to present in a single design, anything likely to be applicable in a large number of cases. The house may be made with either all four sides closed or with one side open. In case the house is put up with one side open, this side should be to the south or east, to admit the sun and keep out the winter storms, which generally come from the north and west in the north central states. In houses having all four sides closed, several large doors should be provided along one side to facilitate the movement of implements in and out. To give plenty of room for the larger implements, the house should be about 16 feet deep and the distance between columns or upright supports should be about 12 feet to take in the widest machines. The roof need not be over 8 feet in height and may be lower if desired. The house should be built long and low, somewhat after the general lines of the wagon shed.

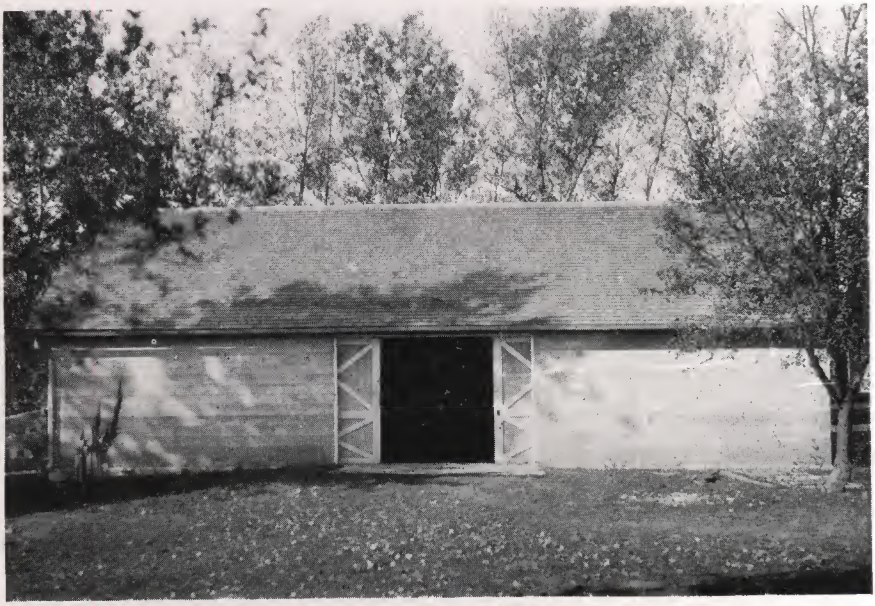

Figure 71. Reinforced Concrete Implement Shed, Echo Valley Farm, Odebolt, Iowa.

Miscellaneous Uses of Concrete

Concrete Stalls and Mangers

Concrete stalls and mangers should always be used in the concrete barn, thus making the interior more sanitary, permanent and fireproof. The fireproof and sanitary advantages of the concrete stall are quite obvious. The concrete manger is clean at the start and can be kept clean. The surface of the manger should be trowelled smooth, particularly on the bottom. In a concrete manger the farmer need have no hesitation in mixing the dry feed with molasses which makes a very appetizing food for the horse, who will lick it up greedily. In no other type of manger can molasses, concentrated feeds, wet mashes, etc., be fed with such ease, economy and cleanliness.

The details of a concrete stall and manger for a horse barn are shown in Figure 72. The partition walls are 4 inches and the walls of the manger are 3 inches in thickness. Both the partition walls and the walls of the manger should be reinforced with a wire mesh or heavy woven wire fencing.

A grating is formed above the stall partitions with iron pipe and ¼-inch round rods, the vertical pipe running down inside the partition and into the floor slab.

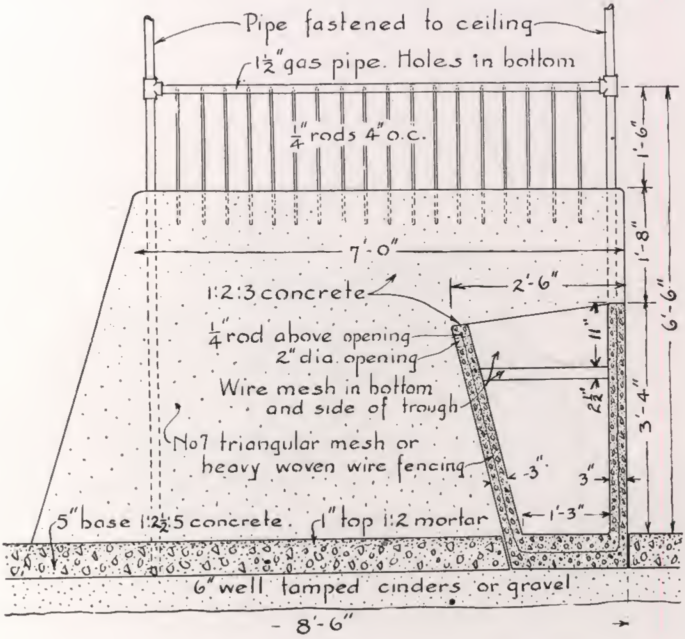

Figure 72. Design for Concrete Stall and Manger.

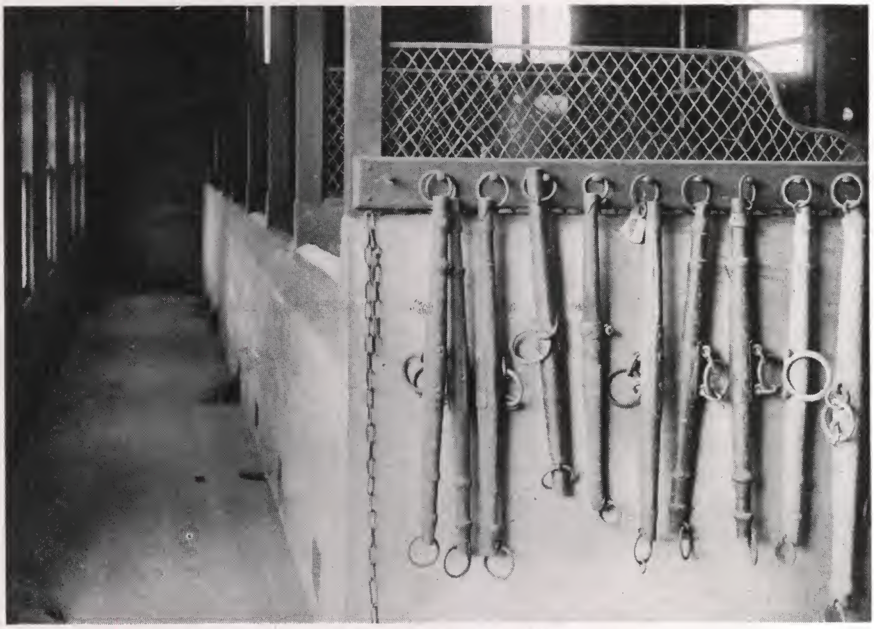

Figure 73. Concrete Stalls in Horse Barn, L. E. Holden, Mentor, Ohio.

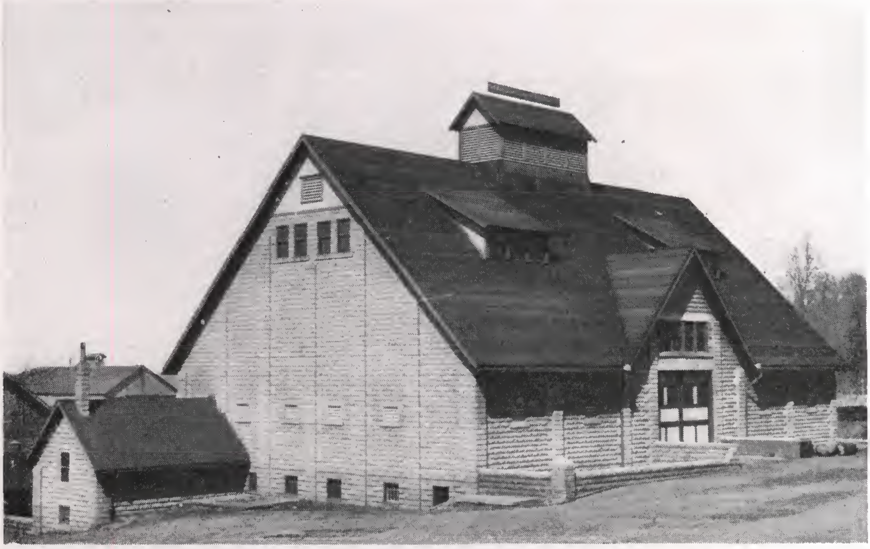

Figure 74. A Horse Barn of Concrete Blocks built against a hillside so that both second story and stable are entered on the ground level—Good Hold Farm.

Nests for Hens *

Concrete is an excellent material for use around poultry houses, because of the fact that it contains no crevices to harbor vermin. This freedom from lice makes it possible for the bird to retain more flesh at the end of the setting period and therefore, more strength. The little chicks are stronger because they are not hatched in the breeding place of hungry lice.

Figure 75 shows an arrangement of concrete hens' nests, concrete dropping platform and roosts that is advisable in the poultry house. The concrete columns and the dropping board should be cast in place but the 2-inch slab to the left of the dropping platform may be cast separately and put in place later. This slab extends to the roof and is intended to prevent drafts from reaching the chickens on the roosts. The nests are cast in sections and these sections are later assembled to form a complete row of nests.

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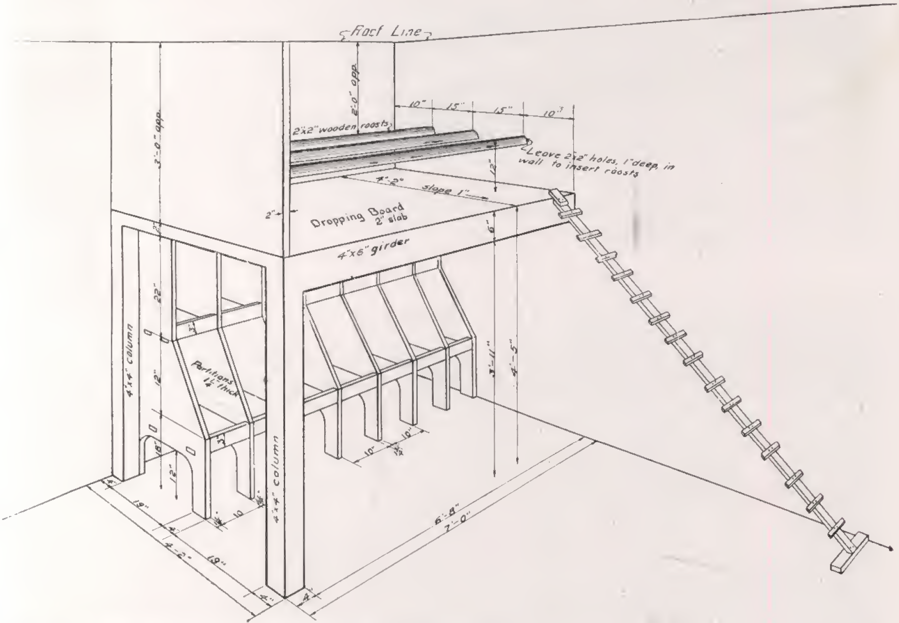

Figure 75. Concrete Hens' Nests and Dropping Board.

Hot Beds

The walls of a hot bed should be constructed similarly to foundation walls and should extend at least 18 inches below the surface of the ground. The front of a hot bed should always be toward the south, the back walls should be higher than the front and the side walls should be sloping in order to obtain more heat from the sun's rays.

The hot bed shown in Figure 76 is an admirable type of such construction work. The walls of the bed are of concrete and the concrete walks around it make it accessible in all kinds of weather.

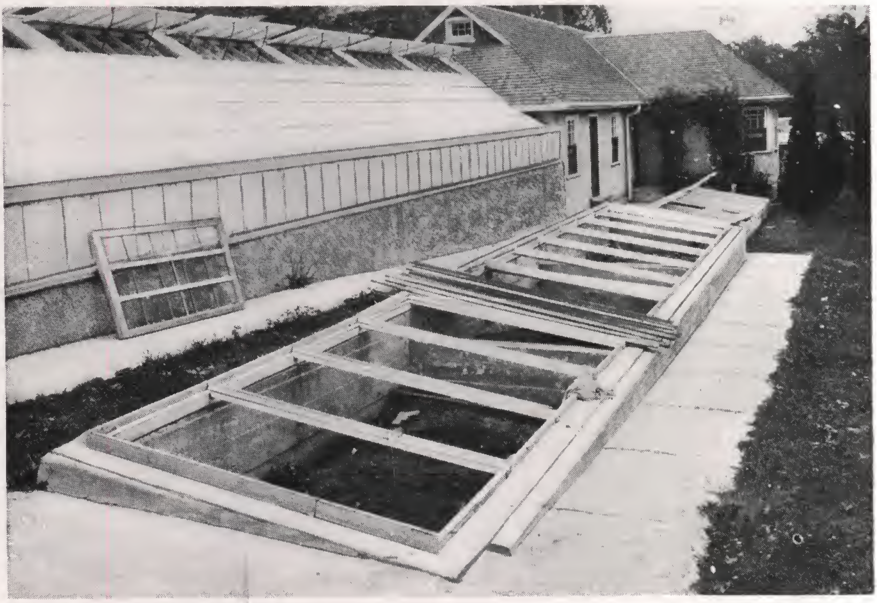

Figure 76. Concrete Hot Bed.

Cob Burners

It is a good plan to provide a cob burner in connection with a hog feeding floor, to dispose of the cobs that would otherwise litter the floor

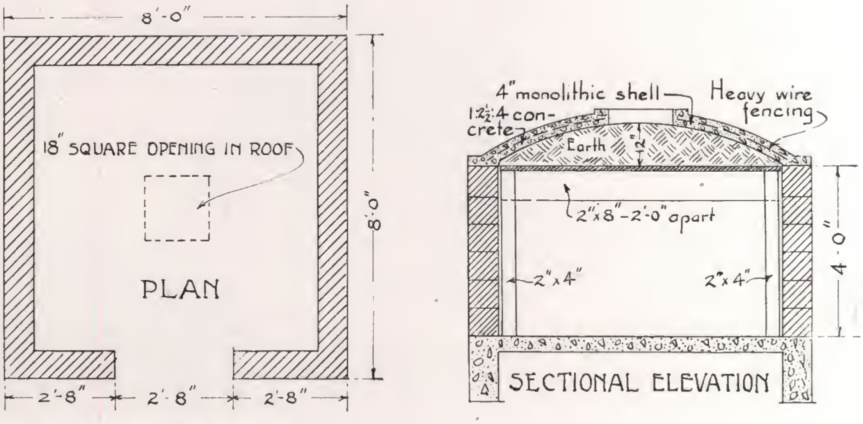

Figure 77. Concrete Cob Burner.

in the surrounding yard. Such a structure protects adjacent buildings against fire and saves the charcoal from the cobs, which is of great value to the hogs. If a cob burner is properly situated the cobs may be swept into it after each feeding and burnt every few days and the charcoal shoveled out as needed.

If the feeding floor has been well laid with a good foundation, a cob burner of blocks may be built directly upon it. Otherwise, it would be well to carry down an eight-inch foundation of concrete two feet below the floor level under the four walls of the burner. Then the floor may be finished and the concrete blocks laid directly upon the floor.

Scale Pits

Of all farm equipment, perhaps none has received less attention than the wagon scales, although one should be provided on all large farms.

The pit shown in Figure 78 was constructed in much the same way as a rectangular concrete water tank. The concrete walls were carried up flush with the ground and given a smooth steel trowel finish. A tile drain from one corner of the pit carries off any rain water that may enter but the walls should be carried two or three inches above the surface of the ground, which should slope away from the pit in all directions, in order to prevent rain water from entering it. Iron eyelets, set in the concrete, form the fastenings for the stock frame which is used only when stock are to be weighed.

The same permanent construction has been used for the beam house which has concrete walls, a concrete top, but a wooden door. Wood was used for the door because of its lightness.

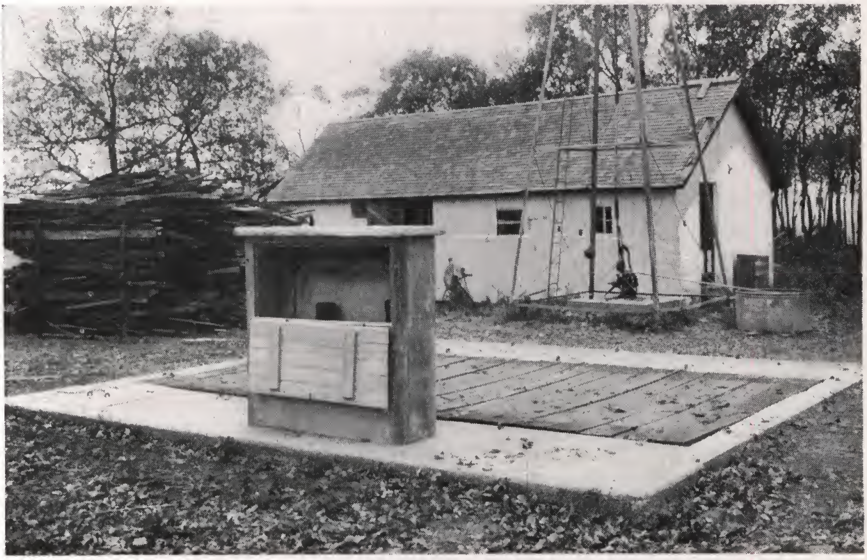

Figure 78. Concrete Scale and Scale Housing Pit of J. Frank Mermond, Monet, Missouri.

Concrete Curbing of Old Wells

One method of constructing a concrete curb in an old well is shown in Figure 79. The curb is formed by means of a collapsible circular form held in place by two inside frames or centers. These inside frames each consist of four pieces cut from 2-inch lumber of suitable width, which, when fastened together by bolts, form a circle with a diameter 2 inches less than that desired for the new well Each frame can be collapsed and removed by loosening the bolts and taking out one or two of them.

The collapsible circular form is made of wood strips 4 feet long and 4 inches wide, cut from 1-inch material. The inner edges of these strips are beveled slightly so as to have no openings on the outer face of the

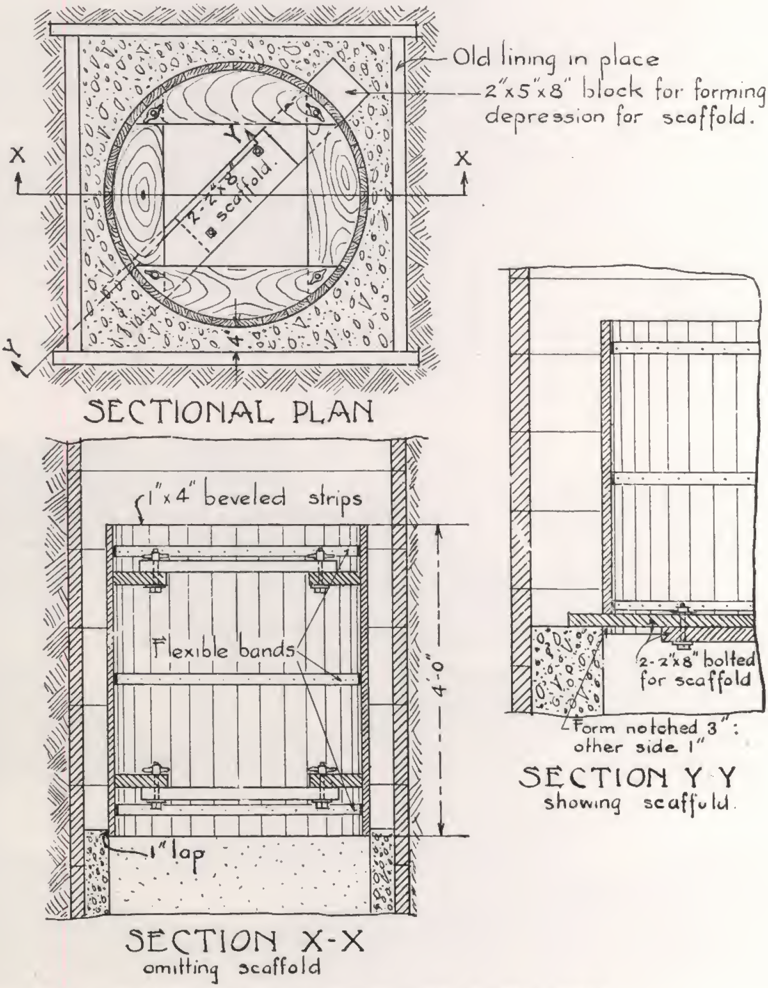

Figure 79. Method of Constructing Concrete Curb for a Well.

form. The strips are fastened together for convenience in handling by bands of thin strap iron, tin or leather as shown in the sketch. This can best be accomplished by nailing these bands on to the wood strips after they have been assembled and drawn tight against the centering by two or three adjustable loops of wire.

One method of curbing the wall is as follows: Set up the form at the bottom of the well, making sure that it presses tightly against the centering. The old well lining will act as an outside form. Fill the bottom with concrete made of 1 sack of cement to 2½ cubic feet of sand and 4 cubic feet of screened gravel or crushed stone. This concrete should be mixed to a consistency just wet enough so that it can be forced into all parts of the form without a separation of the materials. As soon as the concrete has hardened sufficiently, which may take 24 hours or more according to conditions, collapse the centering and raise it entirely out of the well or to the top of the concrete already placed. Similarly collapse and remove the form itself.

Figure 79 also suggests a system which may be used for supporting the forms. A block of the size shown in the sketch is imbedded in the concrete when the latter reaches the top of the form. This block is removed when the form is collapsed and in the depression thus left in the concrete is set one end of a scaffold made of two 2x8's bolted firmly together. The other end rests firmly on the top of the concrete wall on the opposite side of the well. Notches the width of the plank should be cut in the bottom of the form at points exactly opposite each other, the notch in one side being one inch and that on the other three inches in depth. The 1-inch notch fits over the end of the plank resting in the depression. This allows the form to lap 1 inch on the concrete on the section just below, but a greater lap can be obtained, of course, by cutting deeper notches. The form centering can be set up in the new position and another section of the well curb placed by using this plank as a platform. When the form is again raised, the boards can be unbolted and removed and the holes that remain should be filled with cement mortar.

The ends of the plank resting on the walls should be smooth and should be tapered slightly so as to permit of easy removal. The plank should bear at least 6 inches on the concrete, except in the case of a circular well when 4 inches, or the thickness of the side wall, will be sufficient. This system of setting the form, collapsing and resetting for a new section is repeated until the top of the well is reached. It is intended for wells that have already been curbed with boards or brick, so that the old curb will act as the outside form for the concrete.

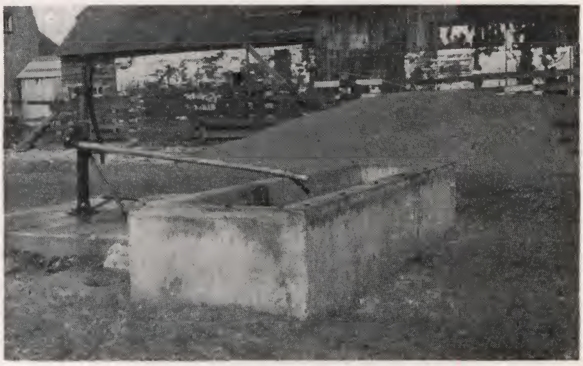

Figure 80. Concrete Well Top and Stock Tank, McLean, Ill.

A strip of sheet iron 4 feet wide and the proper length could be used as a form in place of the wood strips and though perhaps more expensive, might be easier to handle. In this case, however, three centers instead of two should be used and they should form circles equal to the diameter of the well.

The drawing shows the system of lining as applied to a square well, but the same method can be used with a circular well. The minimum thickness of the curb will depend somewhat upon conditions, but for a well 3 feet in diameter the wall thickness should not be less than 4 inches. For wells of larger diameter, a greater thickness would be advisable.

Pump Pits

A pump pit for a driven or drilled well may be constructed as shown in Figure 80. If care is taken in the excavation the earth may be used as an outer form. The inner form should be made in one piece, ready to lower into position when ready. After the excavation has been made the floor should be laid in one course, using concrete proportioned 1 sack of cement, to 2 cubic feet of sand and 3 cubic feet of screened gravel or broken stone, varying in size from ¼ of an inch to 1½ inches in its largest dimension.

The floor is laid 4½ inches thick and when finished off, the inner form should be set in place resting upon the floor. The concrete for the walls is now poured, using the same mixture as that in the floor. A wooden platform is built to support the cover slab. The outer forms for the 6-inch cover slab are staked out with their upper edges at a level 1 inch below the manhole to provide for drainage. When the concrete is filled in to a height of 2 inches, the half-inch reinforcing rods shown on the plan should be placed in position and the forms filled to the top with concrete. The concrete should be smoothed off with a wooden float and should receive a steel trowel finish. Bolts for the pump should be inserted in the concrete before it has hardened, using a template or pattern to assure the proper location. The outer edges of the slab should be finished with an edger, if such a tool is at hand. Care should be taken to place cores in the proper position in the floor and the cover slab of the pit to provide openings for the supply pipe and the pump cylinder. The manhole cover should be reinforced with chicken wire and

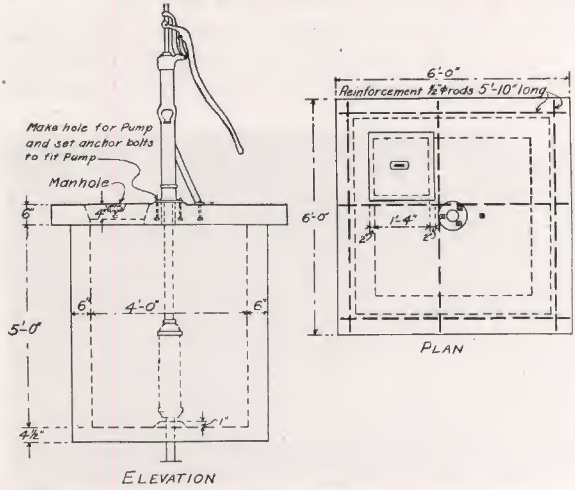

Figure 81. Concrete Pump Pit for Well.

should be provided with a lifting ring attached to a ½-inch rod imbedded in the concrete. To prevent freezing, hay or manure can be placed in the pit and if the floor is tight around the supply pipe, there should be no seepage.

Fence Posts*

The advantages of using concrete posts are so apparent that they need scarcely be mentioned. Probably the most important consideration is their permanence, for a correctly made concrete post, subject to reasonable usage, should last forever. It will neither rot, burn nor corrode. Concrete posts hold a wire fence more securely than any other post and will not heave from frost nor pull up easily from line tension when the fence runs across a hollow. Concrete posts never need be painted and will not be destroyed by worms, insects or other pests. When, in addition to these points, it is remembered that concrete posts can often be made at a cost equal to the price of a good wooden post, it can readily be seen that they form an asset of permanent nature, thus increasing the value of the property and furnishing a good index of the owner's thrift.

Concrete for this purpose should be mixed in the proportions of 1:2:3, that is, 1 sack of cement to 2 cubic feet of sand and 3 cubic feet of screened gravel varying in size from ¼ of an inch to ¾ of an inch in its largest dimension. Circular, rectangular, or nearly rectangular posts can be reinforced with four ¼-inch round rods. These rods should be equally spaced and should be set about ¾ of an inch from the outside surface of the post.

There are a number of commercially made post molds which are giving satisfaction and if a large number of posts are to be made, it will be a

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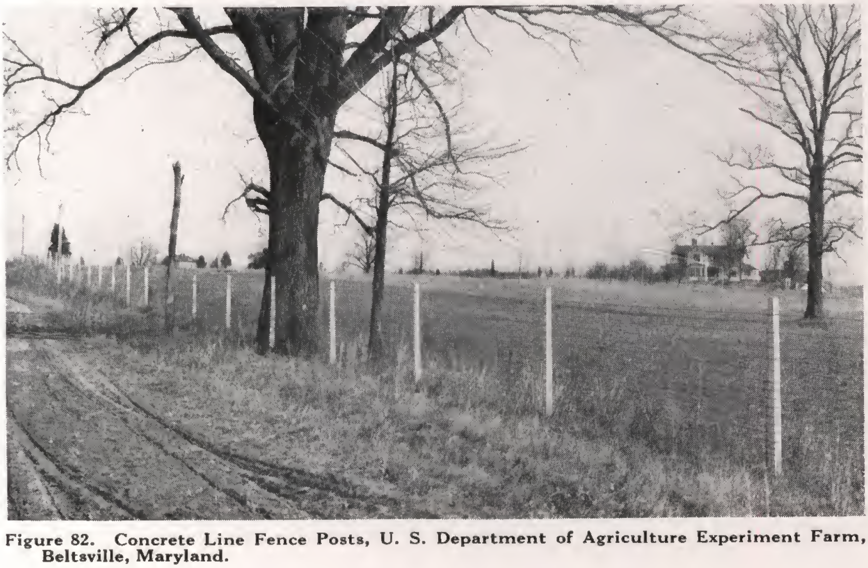

Figure 82. Concrete Line Fence Posts, U. S. Department of Agriculture Experiment Farm, Beltsville, Maryland.

good plan to buy some type of commercial mold. Where only a few posts are to be made, however, a home-made form such as is shown in Figure 84 can be used. This form makes posts 7 feet long, 3 inches square at the top and 5 inches square at the bottom, providing a post tapering on all four sides. The form is constructed entirely of wood and the several pieces are assembled on a platform or plank floor and held in place with blocks and wedges.

Corner Gate and End Posts Corner, gate and end posts will receive more strain than the line posts, hence should have a larger cross sectional area and should contain a greater amount of reinforcing. End posts may be made and cured before setting, similarly to line posts, or they may be molded in place, depending somewhat upon the conditions under which each particular fence is to be built. Where the posts are to be

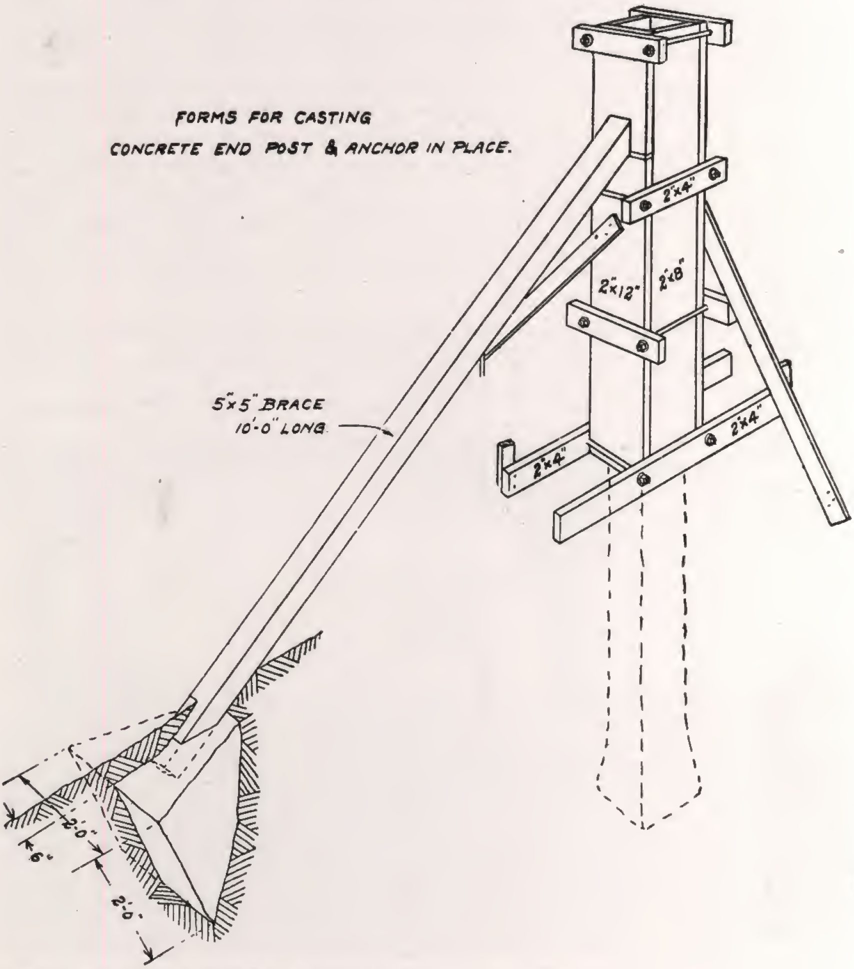

Figure 83. Concrete End Posts with braces in place.

constructed and cured before setting, a simple wooden box mold may be made for the purpose. The weight of a large post will make it difficult to handle and on this account the corner posts are often molded in place. This method is advisable where the post can be properly cured before any strain is put upon it. When the sides of the post hole will stand without caving the earth will serve for a form below the ground. Therefore the hole should be of the size and shape desired for the post. It should be dug with vertical sides and enlarged somewhat at the bottom for anchorage. The concrete should be deposited carefully so that no dirt will be knocked into the hole and mix with the concrete. A form such as is shown in Figure 83 may be used above ground. The method of bracing shown is recommended as the anchor for the brace can best be cast in place. The brace itself should have been previously molded and cured sufficiently for safe handling. It should extend into the post at least 1 inch and should be well imbedded in the anchor at the other end. The earth will serve as a mold for the anchor and the hole should be dug in the shape shown in the illustration. The concrete for the anchor should not come closer than 6 inches to the top of the ground, but should extend below the frost line. As practically all the tension in the wire fence is transmitted to the end post, there is a strong tendency to overturn the post or break it off at the surface of the ground. While this tendency can be overcome by massive construction or heavy reinforcement, it is not economical and satisfactory results can be obtained by using braces such as are shown in Figure 83.

Most farmers have space in the barn or shed which can safely be heated during the cold weather by a stove. Under such conditions the utilization of spare time, in winter, by making concrete fence posts is highly advantageous. The fence posts should be kept in a warm temperature the first 48 hours and protected from freezing for at least a week. The sand and gravel should be free from frost, which can be assured by piling it around an old pipe or smoke stack, and building a fire within. The cement need not be heated but should be stored, inside, in a dry location. The making of concrete fence posts in winter is one of the most efficient ways of reducing fence post troubles and utilizing spare time.

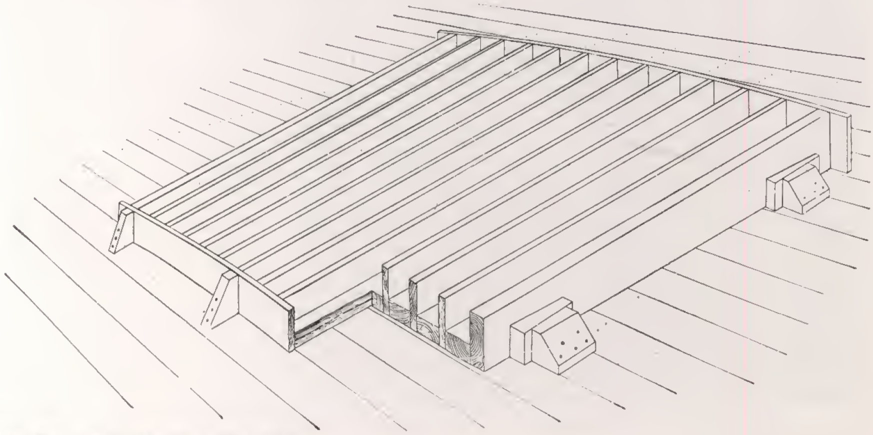

Fig 84. Home Made Post Molds.

Grape Arbors

Concrete for posts in vineyards, all-concrete structures for grape arbors, rose arbors, pergolas, and other similar structures, both useful and ornamental—are highly advantageous. Concrete posts in vineyards are highly economical for a number of important reasons. They do not need repairs, replacement or paint. They do not heave, and their permanency makes it unnecessary ever to disturb the vines. This is not only important in a successful vineyard because such disturbance checks the growth of the grapes, but after the vineyard is once established the constant replacement of posts demands time and money in the spring, when attention more properly belongs to cultivation, spraying and other orchard duties. Insect pests cannot find a haven in concrete posts, nor can field mice and other vermin make nests in them.

Unit members for grape arbors, etc., may be constructed during inclement weather and their ornamental and utilitarian possibilities should not be overlooked by the farmer.

The grape arbor shown in Figure 85 is constructed entirely of concrete and has attracted much favorable attention. Although a minor use of concrete about the farm and home, it is an important permanent improvement.

The post molds were made of wood and were 10 feet long and 6x6 inches at the bottom, tapering to 6x4 inches at the top. Three-eighths-inch steel rods were used in reinforcing, one in each corner of the post. Holes were left in the upper end of the post, in which were later inserted bolts of the proper size to hold the arches. These bolts were cemented in place after erection.

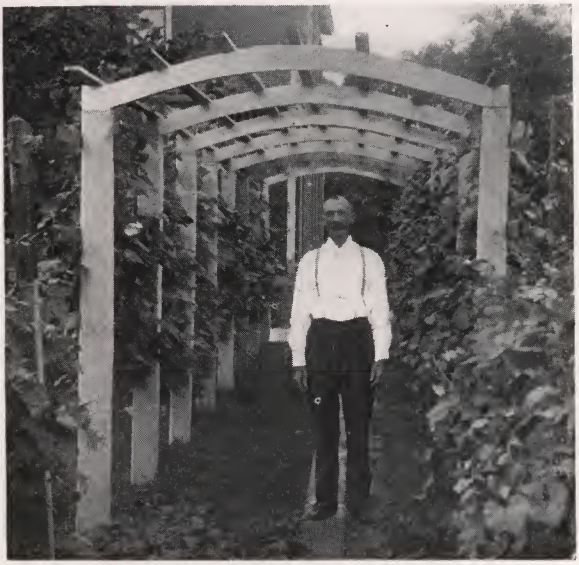

Figure 85. Concrete Grape Arbor of Felix Goebler, Upper Alton, Illinois.

The forms for the arches were also made of wood giving an arched beam of 8-foot span and 10-inch rise, with a flat seat at either end to rest on the posts. These beams were also reinforced with ⅜-inch round rods. Holes were left in the arches for fastening the laths which run lengthwise of the arbor and these were later fastened on with carrige bolts.

The posts were set when six weeks old, having 3 feet of their length under ground and 7 feet above.

Concrete Fences

Improvement of farm homes by artistic decorative work of concrete is easy for a handy man and adds wonderfully to the attractiveness of the yard. Any man reasonably familiar with cement block construction can construct a fence similar to the one shown in Figure 86, at a reasonable cost of time and materials.

Six separate molds are needed for casting such a fence. The wall itself and the pillars are made of plain blocks in two sizes. Above this is a course made up of cast slabs, 4 feet long by 12 inches wide and 6 inches thick, with a bevel on the upper edges. Three of these fill the space between two adjacent pillars. The small cast columns which form the balustrade at the top of the fence are probably the most difficult part of the construction, but if steel or cast-iron molds are purchased, the work will be easy and the results will be good.

After the small columns are cast, they are set up in position and a form is built for the upper rail which is cast in place around the column heads. The ball caps are also cast in iron molds. Ornamental molds for concrete work may be purchased from a large number of firms.

Spare time can be used in making a fence like that illustrated. A few blocks only may be made at a time and they may be laid in the wall as time and opportunity permit.

Monolithic concrete fences are not difficult to cast in place. A smooth finish can be obtained by spading along the inside of the forms and tamping lightly, which causes the mortar to flow to the surface. Pleasing and unusual surfaces can be obtained by selecting different colored gravel and scrubbing the cement away from the stone when the forms are removed, twenty-four hours after the concrete is first placed. Panelled effects are not difficult to obtain if one cares to take a little more time and pains in making the forms. The monolithic concrete fence, when properly reinforced, is everlasting and is a permanent asset to the farm.

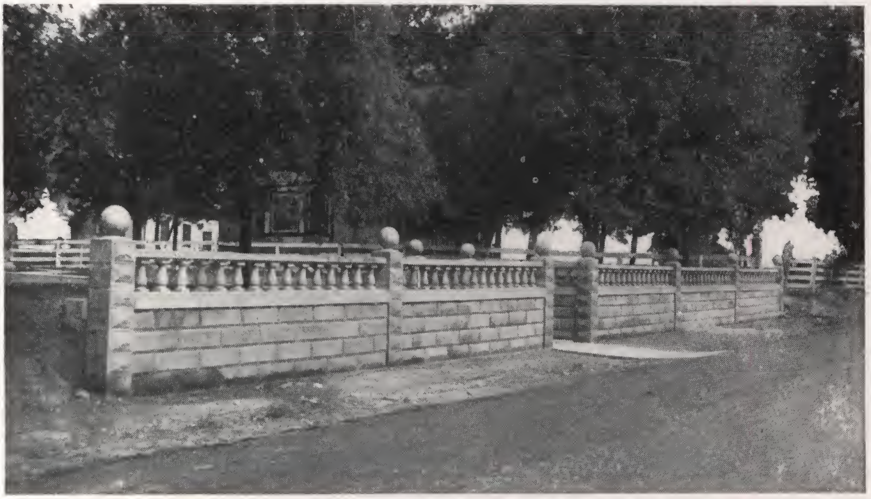

Figure 86. Concrete Fence of H. W. Kahl, Oakland, Maryland.

Concrete Dams

Occasionally the farmer has a stream on his farm, which he wishes to dam up for a pond. The farmer who has been accustomed to think in concrete will naturally use this material for the construction of his dam and it will be the best material to use, for it is easily placed, can be made water-tight and is permanent.

In building a concrete dam, it should be extended back far enough into the banks of the creek to prevent washing out by the water currents and to prevent musk rats from digging holes around it and thus letting water out of the pond. The designs vary so materially to accommodate local conditions and the ideas of the engineer or contractor who is doing the work, that no attempt will be made to give a standard design for this purpose. If the dam is small like the one shown in Figure 88 it may be constructed similar to a foundation wall but a competent engineer should be employed to design a large dam to insure satisfactory results.

The concrete for plain concrete dam construction should be mixed in the proportions of 1:3:5. The screened gravel or broken stone should vary in size from ¼ of an inch to 2 inches in its largest dimension. Where the dam is reinforced, it is customary to use a 1:2:4 mixture. The coarser particles of the aggregate should be carefully spaded back from the face of the wall for the same purpose.

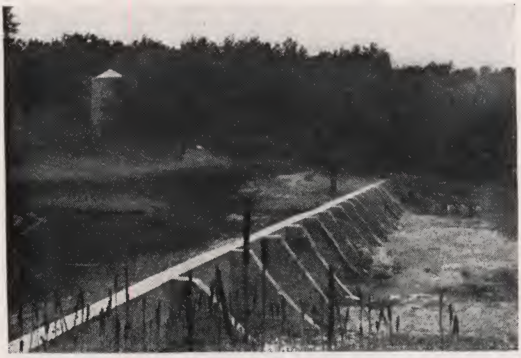

Figure 87. Concrete dam on farm of Chas. S. McNett, Carey, Illinois, 300 ft. long and 10 ft. high. From this dam sufficient power is obtained to supply all farm needs.

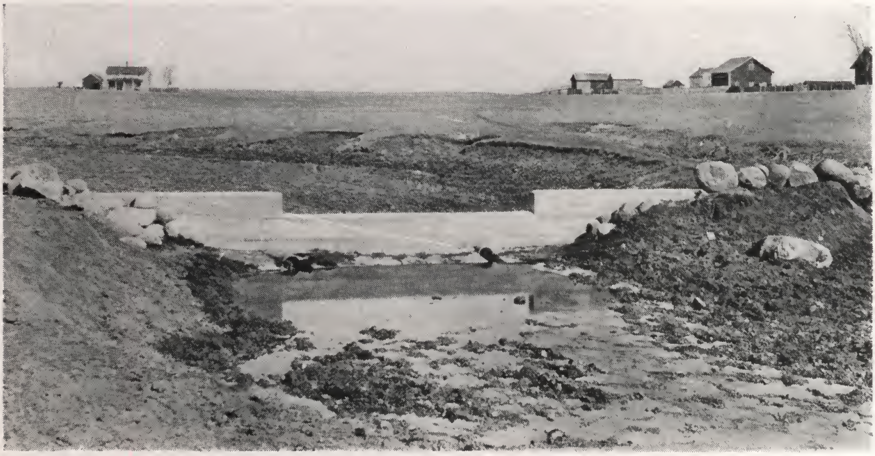

Figure 88. Small Concrete Dam on Funk Farm, McLean, Illinois.

Tree Surgery

The trunk and limbs of shade and fruit trees sometimes become worm eaten and rotten. It becomes necessary to treat the tree in some way to prevent the rot from spreading and the proper method is; first to completely cut out all rotten parts and thoroughly clean the inside of the cavity using a wash of $\frac{1}{4}$ of a lb. of copper sulphate solution to 10 gallons of water; second, to fill the opening with concrete. If the cavity is large, it will be necessary to reinforce it in some manner. This may be accomplished by driving 20-penny nails into the wood in such a manner that they extend out into the opening about 2 inches. In extremely large cavities it will be necessary to reinforce with chicken wire or small iron rods.

Concrete for this purpose should be mixed in the proportion of 1:2:3 and care must be taken in placing it so that the cavity is completely filled. If not completely filled or if all the rotten wood has not been removed, disintegration will continue behind the concrete filling.

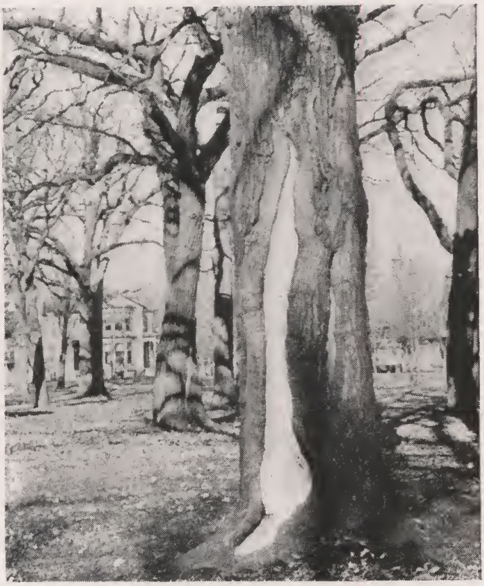

Figure 89. Tree Surgery.

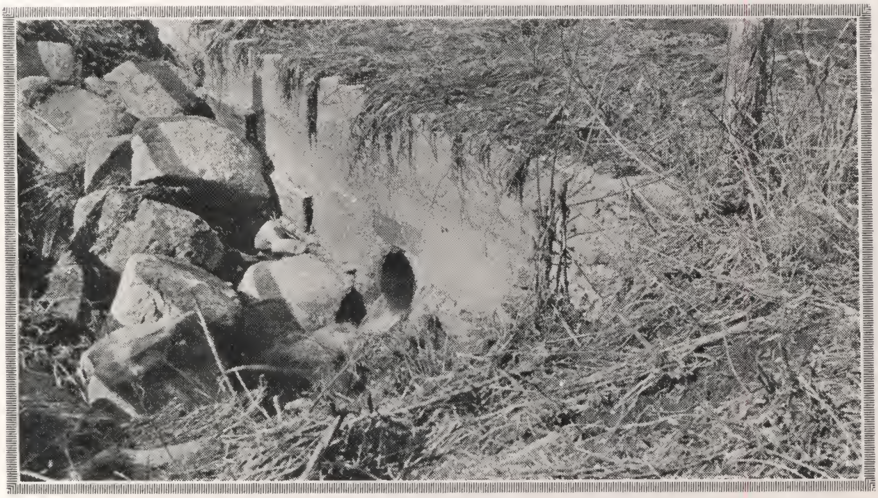

Figure 90. Tile Outlet protected by concrete head-wall.

Bridges and Culverts*

It sometimes becomes necessary for the farmer to carry a stream of water under the farm lane or the farm road.

If only a small amount of water is to be handled, this can be accomplished by laying cement drain tile, properly cemented together with a 1:1½ mortar. The bottom of the trench should slope toward one side of the road so as to furnish the necessary fall toward the outlet. The bottom of the trench should also be shaped to receive the tile in order to provide a solid foundation. The ends of the line of tile should preferably run through concrete end walls to protect the inlet and outlet from undermining. These walls should be of sufficient height above the tile and of sufficient width, to retain the earth fill and should extend well below the frost line to a hard, firm sub-soil.

The concrete for the end walls should be mixed in the proportion of 1:2½:4 and these walls should not be less than 8 inches in thickness. It may be necessary to reinforce them if they are unusually high or wide and in such a case a special design must be made.

Where a large amount of water is to be taken care of, it may be advisable to use a concrete arch or a flat slab concrete culvert.

No road, however good, is better than the weakest bridge or culvert in its length, which is just another way of saying that no chain is stronger than its weakest link. Farmers are more interested in permanent types of road than other citizens, because they use them for both freight

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*"Small Concrete Bridges and Culverts"; distributed free by the Universal Portland Cement Co.

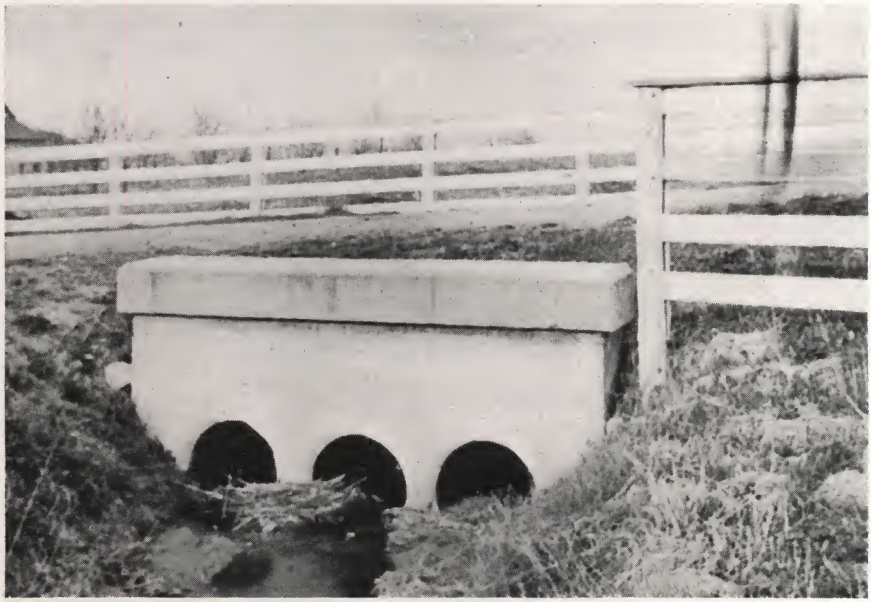

Figure 91. Concrete Pipe Culvert on a road leading to Indianapolis along the right of way of the Pennsylvania lines.

and passenger traffic while the average citizen uses them only for recreation. If the roads are very bad in one direction, the city man can just as well drive or motor to some other town, but the farmers' goods must get to market. Culverts and bridges in the country, should, therefore, be made of a permanent material, which will not cause a constant drain on the taxpayer's pocket for painting, repairs and replacement. Heavy hay teams, traction engines, automobiles and auto trucks belonging to the farmer, or people who work for him, must go over the country roads. Many a bad stretch of road could be improved by the building of an inexpensive concrete culvert and where bridges are needed the wider the stream the greater the necessity for a safe and permanent structure.

When the efficiency of the concrete bridge is appreciated, it is only a step to extend the bridge in both directions as a concrete road. A concrete road is a bridge over a mud hole and increases the load which can be carried to market five times and the value of the adjoining property by the hundreds of dollars.

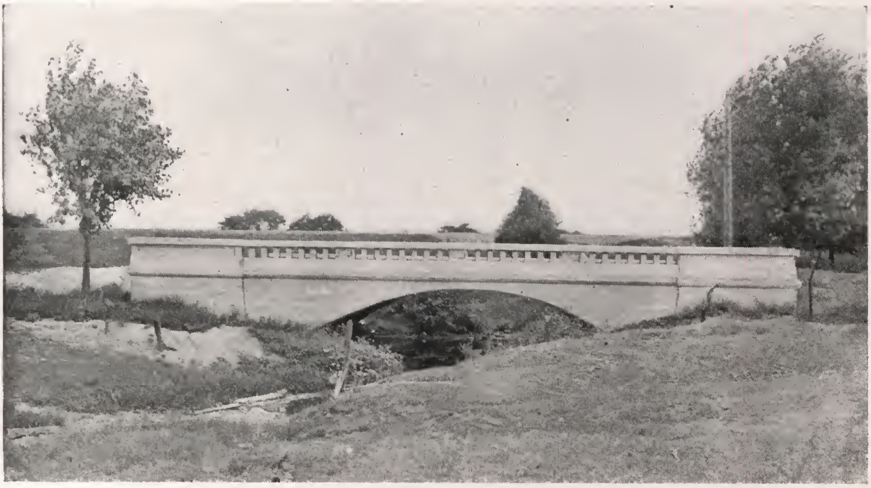

Figure 92. Reinforced Concrete Arch Bridge, Bloomington, Illinois.

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